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## Supplemental Digital Appendix 1

### Goals, Objectives, and Activities for Physician Scientist Training Program Courses at the University of Pittsburgh School of Medicine

| Course  | Level/Frequency   | Course Goal  | Objectives, students will:   | Activities   |
|---|---|--|--|--|
| Professional Development 1 (PD1)                    | Summer, Pre-MS1<br><br>2x/week, 10 weeks                                  | Goal is to orient students to key research and career resources and skills | <ul style="list-style-type: none"> <li>•Articulate key research question, scientific strategies, methods, work-work and work-life balance of guest faculty</li> <li>•Draft compelling abstracts for (abstract-censored) articles under discussion</li> <li>•Communicate approaches to maximize rigor and reproducibility</li> <li>•Communicate own work in chalk talk</li> <li>•Describe optimal features of a mentoring relationship</li> </ul> | <ul style="list-style-type: none"> <li>•Discuss and present summer research, sources of error, rigor, reproducibility, graphical literacy</li> <li>•Meet with 8 MD-only physician scientists, discuss research and career path</li> <li>•Introduction to institutional bioinformatics software and basic biostatistics review</li> <li>•Identify features of a good or a bad mentoring match for themselves</li> </ul> |
| Research Basis of Medical Knowledge Courses 1 and 2 | MS1 ( <b>taken with MSTP students</b> )<br><br>Weekly, evenings, Sept-May | Goal is to build skills in literature and data analysis.                   | <ul style="list-style-type: none"> <li>• Increase understanding regarding the research basis of medical knowledge.</li> <li>• Learn how to review primary literature critically.</li> <li>• Learn how to present primary literature.</li> <li>• Learn how to discuss scientific results with peers.</li> <li>• Understand a broad range of research topics</li> </ul>  | <ul style="list-style-type: none"> <li>•Highlights research/clinical intersection through journal club readings, clinical/research case presentations by alumni and writing exercises.</li> <li>•Journal club articles are aligned with concurrent SOM curriculum; presenting students vet their talk with a local faculty expert in advance of class.</li> </ul>  |

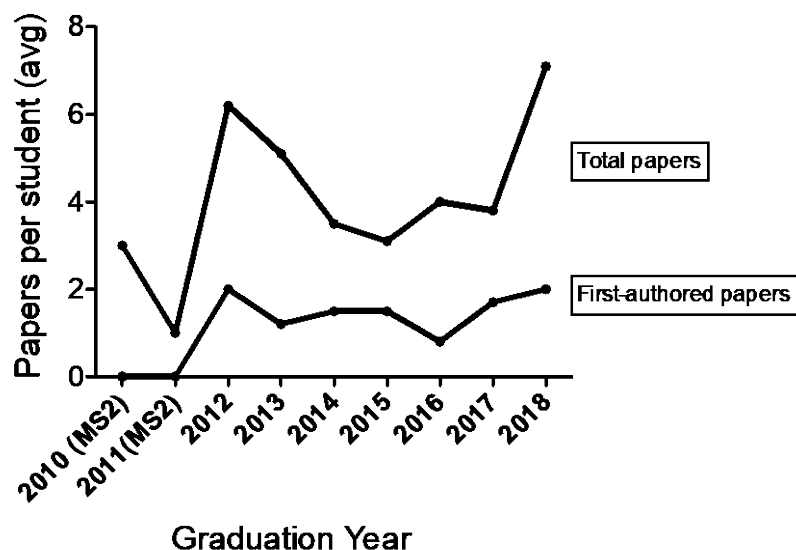
|                                       |  |   |  |   |
|---------------------------------------|--|---|--|---|
|                                       |  |   | <ul style="list-style-type: none"> <li>•Productive interaction of PSTP students with MD/PhD students and research faculty in Pittsburgh.</li> <li>• Build communication skills broadly, including the ability to generate a complete and coherent biosketch.</li> </ul>  | <ul style="list-style-type: none"> <li>•Homework questions on manuscripts and <i>Nature</i> Life Sciences checklist are prepared in advance of class.</li> </ul>  |
| Professional Development 1 (PD2)      | Summer, Pre-MS2<br><br>Weekly, 8 weeks                                     | Goal is to build grantwriting skills                  | <ul style="list-style-type: none"> <li>•Articulate organizational and scientific features of proposal components, training plans and recommendation letters that make them compelling</li> <li>•Articulate strong and weak points of sample training plans and grant proposals.</li> <li>•Ability to craft portions of a proposal clearly and coherently.</li> <li>•Ability to further develop grant proposal for submission to HHMI or alternative funder.</li> </ul> | <ul style="list-style-type: none"> <li>•Students learn about and write draft Specific Aims, Significance, Innovation, and experimental plan for one aim.</li> <li>•Prepare for and participate in a mock study section along with guest faculty.</li> </ul> |
| Research Basis of Medical Knowledge 3 | Fall, MS2 ( <b>taken with MSTP students</b> )<br><br>Weekly, Sept-December | Goal is to deepen analytical and communication skills | <ul style="list-style-type: none"> <li>•Learn how to review primary literature critically.</li> <li>• Learn how to present primary literature.</li> <li>•Learn how to communicate effectively generating one's own</li> </ul>  | <ul style="list-style-type: none"> <li>•Discuss strong and weak points of SOM-aligned translational research articles and identify experiments which completely and which partially resolve hypotheses</li> </ul>   |

|                            |  |  |  |  |
|----------------------------|--|--|--|--|
|                            |  |  | report/argument in writing.  | which are presented.<br>•Exercises to build communication skills in paper-writing, abstract writing, op-ed writing, elevator pitches.                                      |
| Work-in-Progress talks     | Continual<br><br>Monthly<br>(2-3 talks/90 minutes) | Goal is to build skill in presenting and testing of hypotheses and build program identity in a collaborative learning environment. | <ul style="list-style-type: none"> <li>•Presenting work in chalk talk format</li> <li>•Ability to constructively critique work presented from multiple disciplines</li> <li>•Collaborating to answer scientific questions</li> </ul> | •Chalk-talk presentations to the entire PSTP membership  |
| PSTP workshops             | Continual<br><br>2-4 times yearly                  | Goal is to share information important to career planning and professional development   |  | <ul style="list-style-type: none"> <li>•Responsible conduct of research seminars</li> <li>•Research residency presentations</li> <li>•Time-management exercises</li> </ul> |
| Research Rotations 1 and 2 | Pre/post MS1<br><br>10 week rotations              | Goal is to define and attain intellectual, professional and technical goals for rotation.  | <ul style="list-style-type: none"> <li>•Identify research year mentor</li> <li>•Abstract and poster/talk presentation at PSTP Annual Retreat</li> </ul>  | <ul style="list-style-type: none"> <li>•Plan, generate and interpret data</li> <li>•Assess mentor match</li> </ul>   |
| Research Year              |  | Goal is to build research independence   | •Self-direction  |  |
| Clinical Reentry Elective  | End of research year                               |  |  | Nongraded weekly session with surrogate patients guided by master  |

|                              |                           |  |  |   |
|------------------------------|---------------------------|--|--|---|
|                              |                           |  |  | <p>clinician (3-4 afternoons)</p> <p>Those doing 2 years of research have a formative non-graded 2-week intensive inpatient rotation prior to official medical school reentry.</p>  |
| PSTP research month elective | 1-2 months during MS3/MS4 |  | <ul style="list-style-type: none"> <li>•As needed to finalize projects, respond to manuscript critiques or rotate in a laboratory relevant to residency plans</li> </ul> | <p>Additional research time either to extend the research year or to return to the laboratory in MS4 to complete deliverables or develop new skills</p>   |
| PSTP Career Advisor Meetings | Continual<br>2X per year  |  |  | <p>Career Advisor (generally physician scientist) is assigned prior to matriculation</p> <ul style="list-style-type: none"> <li>•Review updated biosketch, reflective self-assessment and individualized development plan. Review progress, obstacles and opportunities.</li> <li>•Guide mentor selection, assist residency planning</li> </ul> |

## Supplemental Digital Appendix 2

### The Mean Number of Publications per Student in the Physician Scientist Training Program at the University of Pittsburgh School of Medicine, Grouped by Year



Average total and first-authored papers or publications per student based on listings in PubMed. Papers published post-graduation were credited to medical student tenure if the listed affiliation was Pittsburgh and either the senior author or academic focus matched the authors records for the student. Review articles were included in the analysis.

## Supplemental Digital Appendix 3

### Exploratory Analysis of Matches by Graduates of the Physician Scientist Training Program at the University of Pittsburgh School of Medicine into NIH Top-10 Programs, Excluding (Table A) and Including (Table B) Harvard Residencies

**Table A\***

| Program                  | Graduate year | Number of graduates | Matched to top 10 residency in specialty (NIH \$) | Residency match (NIH \$) by quartiles |           |              | Harvard hospital matches (not included) | ANOVA  |
|--------------------------|---------------|---------------------|---|---------------------------------------|-----------|--------------|---|--|
|                          |               |                     |   | Top 25%ile                            | 26-50%ile | Below 50%ile |   |  |
| PSTP                     | 2010-19       | 46                  | 26 (57%)  | 33 (72%)                              | 7 (15%)   | 6 (13%)      | 2                                       | $P > 0.05$<br>PSTP v<br>MSTP<br>$P < 0.001$<br>PSTP v<br>SOM |
| MSTP                     | 2010-19       | 76                  | 40 (53%)  | 53 (74%)                              | 8 (11%)   | 15 (20%)     | 13                                      | $P > 0.05$<br>MSTP v<br>PSTP<br>$P < 0.001$<br>MSTP v<br>SOM |
| Non-MSTP, non-PSTP (SOM) | 2010-19       | 1181                | 350 (30%)   | 516 (43%)                             | 209 (18%) | 456 (39%)    | 62                                      |  |

\*Matching of PSTP, MSTP, and other medical students into research residencies. Using ANOVA with Tukey's post-hoc analysis, the authors compared percentile rank distribution among groups. Matches to programs not achieving rank on corresponding Blue Ridge departmental lists were assigned a percentile of 1.0.

**Abbreviations:** NIH, National Institutes of Health; ANOVA, analysis of variance; PSTP, Physician Scientist Training Program; MSTP, Medical Student Training Program; SOM, school of medicine.

**Table B\*\***

| Program            | Graduate year | Number of graduates | Matched to top 10 residency in specialty (NIH \$) | Residency match (NIH \$) by quartiles |           |              | ANOVA  |
|--------------------|---------------|---------------------|---|---------------------------------------|-----------|--------------|--|
|                    |               |                     |   | Top 25%ile                            | 26-50%ile | Below 50%ile |  |
| PSTP               | 2010-19       | 48                  | 28 (58%)  | 35 (73%)                              | 7 (15%)   | 6 (13%)      | $P > 0.05$<br>PSTP v<br>MSTP<br>$P < 0.001$<br>PSTP v<br>SOM |
| MSTP               | 2010-19       | 89                  | 53 (60%)  | 66 (74%)                              | 8 (11%)   | 15 (20%)     | $P > 0.05$<br>MSTP v<br>PSTP<br>$P < 0.001$<br>MSTP v<br>SOM |
| Non-MSTP, non-PSTP | 2010-19       | 1243                | 412 (33%)   | 578 (47%)                             | 209 (18%) | 456 (39%)    |  |

\*\*Matching of PSTP, MSTP, and other medical students into research residencies (assuming Harvard Hospital matches in top 10). As Table A (above), but including Harvard Hospitals with a percentile rank assigned as 0.05.

*Abbreviations:* NIH, National Institutes of Health; ANOVA, analysis of variance; PSTP, Physician Scientist Training Program; MSTP, Medical Student Training Program; SOM, school of medicine.



## Supplemental Digital Appendix 4

### Free-Text Comments Regarding the Physician Scientist Training Program at the University of Pittsburgh School of Medicine From Students Who Have Participated in the Program, Organized by Question and Theme (as Determined by the Authors)

#### ➤ *Has your training in the PSTP helped your career? If so, how?*

Of the 45 comments for this question, 44 individuals have found PSTP to be helpful. Below are some examples of praise for PSTP.

- “I would not be where I am today without the support from PSTP. It has formed the foundation for all the publication and research successes I've had thus far, which in turn has made me a very competitive applicant and distinguished me from my peers. For someone who has their goals set into academic medicine, I could not think of a more perfect program to supplement my medical training.”
- “My PSTP training has helped immensely. I found it was especially useful when applying to fellowship - as fellowship program directors were much more interested in the research that I did, rather than residency PDs”
- “I consider training in the PSTP to be the most influential and beneficial thing I did during medical school.”
- “Yes, tremendously. It was a distinguishing factor during the residency application process. Almost everyone on the interview trail asked about the PSTP.”

Survey respondents mentioned the following ways in which PSTP has helped their career, in order of frequency of appearance:

#### 1. Developing and improving research skills (23 comments)

- “The parallel curriculum of the PSTP such as journal clubs, research seminars, and grant writing classes has provided me with a foundation for critically analyzing scientific literature and formulating research questions. The dedicated year of research time afforded me the opportunity to establish myself in the peer reviewed literature, a requisite for a successful career in academic medicine.”
- “My training in the PSTP had expected positive impacts on my research experience and knowledge, but also has had just as much of an impact on my clinical training. Through journal clubs, didactics, and my laboratory research I learned the invaluable skills of critical thinking, hypothesizing, testing, planning, organization, etc etc. All of these skills are invaluable as a clinical resident, and certainly continue to help me in my research efforts as well.”
- “The PSTP has given me a tremendous leg up on my peer group in terms of research training. I am able to critically appraise not just basic science, but clinical research for

study design and manuscript preparation. It has actually made it possible for me to spend less time learning about research and more time DOING research as a postgraduate.”

- “My research experience has allowed me to speak fluently with other physician-scientists in the field, leading to productive collaborations. The frequent presentations in PSTP classes and retreats developed my skills as a public speaker...The PSTP's journal clubs and dedicated research time sharpened my critical thinking, which has been important in pursuing new investigations. Lastly, the grant writing exercise for the HHMI Med Fellows program was a unique and invaluable experience in science writing. I have not encountered colleagues at my stage of training who have received this breadth of exposure in physician-scientist training unless they were enrolled in a MD-PhD program.”

## 2. Supporting career advancement opportunities (19 comments)

- “Using what I have learned in the program, I successfully applied for an HHMI research fellowship, trained under a fantastic research mentor, and published my work in a high-impact journal. All these were immensely helpful in my residency application and ultimate match at a competitive residency program with a strong research focus.”
- “In particular, I have been able to make the transition back to research much more easily because of the PSTP training in the areas of professional development (grant writing, presenting research, critical analysis of the literature).”
- “My PSTP training has helped immensely. I found it was especially useful when applying to fellowship - as fellowship program directors were much more interested in the research that I did, rather than residency PDs”
- “The research experience that I gained and publication history has helped with my candidacy throughout my career endeavors. Although I am not currently performing basic science research, I think that the experience has shaped the way that I approach patients with an analytical mind. This has helped ensure that I take excellent care of my patients and has helped me find my niche as a clinical educator.”
- “It's a bit difficult to say at this point but I have noticed that I have more med school research experience than the majority of interns that I have worked with so I can infer that I will stand out against most applicants as well.”

## 3. Providing research opportunities and helped generate scholarly output (11 comments)

- “Although I am not currently involved in research, it has given me the foundation necessary to jump into a clinical research project should I decide to re-enter the research field.”
- “The research conducted during my time as a PSTP and the 3 resulting publications were crucial in obtaining a research fellowship following completion of my clinical training.”
- “Provided uninterrupted research time between MS2 and MS3 to undertake a project which resulted in data which is of publishable quality.”

## 4. Mentoring (10 comments)

- “First, the PSTP helped me identify qualities that were important in good mentors.”

- “The PSTP connected me with excellent and supportive mentors that guided my career decision making.”
- “It has helped me become more confident in critically appraising literature, discern good from bad mentors, and helped me tap into a professional network.”
- “The exposure to multiple mentors during the PSTP has allowed me to identify new mentors who will support my career and further education.”

5. Networking (8 comments)

- “Opportunities to networking, research, training in grant writing is essential in my future research career.”
- “It has helped me network with physician scientists and has enlarged my career focus.”
- “The PSTP has helped my career with a high magnitude - from adjunct courses that facilitate my development as a physician scientist to networking opportunities, I feel that it will prepare me well for doing research as a physician in the future.”
- “The PSTP has exposed me to various professionals whose experience and expertise has better prepared me for the early and latter parts of my career. “

6. Opportunity to expand/explore interest in research (3 comments)

- “It has helped me explore my interest in research, master basic research techniques, gain an understanding of study design, interpretation and presentation of results”
- “The pace of medical school is so fast that there is no time to stop and explore. You simply keep on the treadmill and hope to keep from falling off. The PSTP enabled me to explore a field, and really piqued my interest in a disease (which continues to be the focus of my work now).”

7. Providing financial support (3 comments)

- “Additionally, the financial benefit cannot be overlooked. If I had been saddled down with huge debt, I definitely would have had to think much harder about choosing my current field, which unfortunately is not a well-compensated one, but one in which I have much clinical and research interest. “
- “The PSTP provided me with funding during my first two summers in medical school to support my research and also continues to support me through tuition scholarships. Though I did not utilize stipend support during my research year, it was reassuring to know that the PSTP would support half of my research year stipend. The PSTP effectively reduces student financial burden in the form of summer stipends, research year stipend, and tuition scholarships.”
- “It helped with the financial burden of medical school, so I am now able to focus more on my research, and worry less about paying off student loans. Being part of the PSTP program has been a critical step in my ability to pursue academic medicine.”

➤ *Please identify any additional factors that would **encourage** or make it easier for you to pursue a career as a physician-scientist.*

Facilitators that came up in 42 total comments are listed below, in order of frequency of appearance:

1. Funding Opportunities (13 comments)

- “A less bleak funding situation on the horizon, particularly for early career investigators trying to ‘break into’ establishing consistent funding for their academic careers”
- “Assurance that funding opportunities for research will remain and/or grow by the time I finish my clinical training.”
- “Less competitive grant environment. Seeing more early and mid-level researchers be successful as opposed to dropping out of research because of lack of funding. “
- “The critical issue is being able to obtain funding. So far I have been extremely lucky to work with mentors and departments that have funding, and I have applied for a K award. However, I have seen several fantastic physician-scientists have difficulty with obtaining an R01 and become independent researchers.”

2. Mentoring (10 comments)

- “Access to additional mentors in my specific field of interest”
- “Having mentors at every point of the way through transitions from medical school to residency to fellowship.”
- “I think that sometimes some of us have been particularly interested in choosing mentors who are either MD/PhD or MD only, since we are worried we won't get the same mentoring experience from a PhD only mentor. PhD PIs can definitely provide valuable mentorship, but it could be less daunting if a PhD PI who has not yet had a PSTP student in his/her lab could have a conversation with another PI who has had a PSTP student in order to become more familiar with the program goals.”
- “I think the importance of mentoring cannot be overstated. It helps to see how physician-scientists have shaped their careers and they are the ones who are most able to provide guidance to students who are looking to become physician scientists.”
- “The biggest obstacle I have found in my postgraduate training is simply having a laboratory or research mentor within the department who is doing basic science and can help you. There is really no time when you are a resident or fellow to start a basic science project from scratch or to establish a relationship with a lab outside of your department where one does not exist when you are a trainee. These relationships existed in Pittsburgh and were much more challenging to find as a resident. I cannot imagine a way that ANY person who is not an MD/PHD would ever choose to pursue a basic science career after they completed their clinical training without a program like the PSTP. It would be virtually impossible.”

3. More dedicated/protected research time (10 comments)

- “Though there are many factors, protected research time and work-like balance are highly influential in my decision to pursue a career as a physician-scientist.”
- “An additional factor that would make it easier for me to pursue a career as a physician-scientist would be more allocated time for research activities during medical school. For example, I think that it would have been more manageable to prepare a complete grant application during my second year of medical school if I was given more time specifically devoted to grant writing in place of an afternoon of lectures once per week or in place of the weekly journal club.”
- “Greater flexibility in taking more research months during MS3 and MS4.”
- “more opportunities to present work and ways to stay engaged during the clinical portion of medical school”

4. Completing/continuing a dedicated track/program (5 comments)

- “A dedicated research track in in surgical residency that would allow for application of K awards and other independent grants”
- “A formal continuation program with guaranteed residency/fellowship placement and mentoring/protected time through Pitt.”
- “Access and time for structured training in research, as a post-graduate”
- “Perhaps direct-to-residency research tracks at my own institution, though unlikely given limitations through the NRMP match process.”

5. Seeing role models (3 comments)

- “I think seeing examples of people who aren't "traditional" success stories might be nice. Most of the physician-scientists we see through the program have had a very linear and conventional path to becoming a physician scientist (all were received K's and R's). If it's possible to have a non-traditional path where they met challenges (maybe didn't receive funding, overcame other obstacles etc) along the way, that would be really helpful to hear. Sometimes it can be overwhelming to hear all of these success stories and to think that if I don't get an R, I will no longer be able to be a physician scientist.”
- “Seeing more early and mid-level researchers be successful as opposed to dropping out of research because of lack of funding.”
- “We have seen several young physician scientists in panels and presentations, but I think it would be interesting to also learn from physician scientists who have been practicing medicine and conducting research for some time and find out what they have accomplished and what they have found to be the most rewarding.”

Less common facilitators (those mentioned by only one or two individuals) included: connection to PSTP alumni, having a shorter training period, having a supportive department/environment, access to established labs, more networking opportunities, assistance with matching, access to a dedicated behavioral/wellness services or counselor, more institutional recognition of physician-scientists, having a supportive family/spouse, and more certainty in their ability to successfully make it as a physician-scientist.

➤ *Please identify any additional factors that would **discourage** or make it more difficult for you to pursue a career as a physician-scientist.*

Barriers that came up in 19 total comments are listed below, in order of frequency of appearance:

1. Finding funding/compensation (6 comments)
  - “Limited funding remains a significant issue”
  - “Differential compensation in academics”
  - “Difficulty obtaining and retaining grant funding”
2. Starting a lab/having infrastructure for research (3 comments)
  - “There is a great deal of activation energy that goes into building a lab, so having an infrastructure in place is so important.”
  - “Not a lot of research labs with topics of interest at my residency program”
  - “There not being an existing track of experienced junior researchers or responsible graduate students who would conduct the work”
3. Finding a position (2 comments)
  - “Job opportunities for a physician-scientist after training. How do you find an academic position?”
  - “Competition for obtaining a faculty position.”
4. Gender barriers (2 comments)
  - “Gender biases can play a role”
  - “Difficulty in finding female mentors.”
5. Passion/research interest (2 comments)
  - “My clinical interests that involved staying in general medicine rather than specializing.”
  - “Not having a research question I am passionate about.”

Less common barriers (those mentioned by only one individual) included: having insufficient departmental support, having a high debt burden, little time to have a family, keeping clinical skills honed, the perception that you can't be both a superb researcher and clinician, and dealing with the extra time necessary for training.

➤ *Have you (were you) been able to identify a helpful mentor in academic medicine? If so, how was this person most helpful to you?*

Of the 46 comments, 41 were able to identify at least one mentor.

Ways in which their mentor(s) have been helpful are listed below, in order of frequency of appearance:

1. Acting as a role model and providing guidance (29 comments)

- “It had been helpful to hear different people's stories and about the different paths that they took. Knowing that there isn't just one way to reach a goal is reassuring.”
- “My mentor was not only well-respected for his scientific work, but also beloved for his generosity and openness in sharing with scientific community to advance research. He was the perfect role-model for the type of physician scientist I aspire to be: an excellent scientist, a strong clinician, and an equally great person and member of the scientific community.”
- “Yes, I am currently working with a pulmonologist who shares my interest in using imaging to further characterize early lung adenocarcinoma. His expertise in the field has helped to guide me in asking the most high yield questions of our research work, and frame it in a clinical context. He has also been a wonderful clinical mentor, providing me with wisdom in the setting of very challenging patient cases and the development of my medical reasoning.”
- “Yes, my research mentor has provided me with not only great opportunities in research, but also career and life advice about a career as a physician-scientist. He has been very supportive and that has allowed me to form a strong mentor-mentee relationship with him.”
- “Yes, the most helpful mentors are the ones who provided practical advice on how to navigate each stage of the transition.”

## 2. Helping to bolster research skills (10 comments)

- “My mentor offered me constructive feedback regarding ways to improve my presentation skills during lab meetings and my writing skills when crafting abstracts, posters, and grant applications.”
- “He has taught me how to design a high quality research study, how to interpret data using multiple approaches, and how to creatively represent data in presentations and in publications. His enthusiasm and motivation for scientific discovery is contagious.”
- “Specifically, they were there to mentor me in important junctures such as submitting grants, med school applications, residency applications, journal article submissions, etc. Without their expertise I certainly would not have wound up where I wanted in my training pathway.”

## 3. Helping find resources and opportunities (6 comments)

- “My mentor informed me of unique opportunities to which I should consider submitting my research to. He encouraged me to apply to local research symposiums as well as a national research meeting that I was not aware of beforehand.”
- “They have been extremely helpful in terms of identifying grants that I can apply for”
- “Yes, helpful in identifying labs and research opportunities, clinical shadowing”

## 4. Networking (5 comments)

- “After mentioning to my mentor my interest in pursuing an internal medicine subspecialty, he introduced me to the IM program director at UPMC. My mentor also identified individuals who could potentially be good resources as I navigate my research

project. Overall, my mentor supported my research endeavors by introducing me to individuals within the academic medicine community at Pitt Med.”

- “Networking on my behalf.”
- “My primary mentor in residency is very open to introducing me to people over email”

Less common ways mentors were helpful (those mentioned by only one or two individuals) included taking the time to meet with them and showing interest and enthusiasm in their research and projects.

### ➤ *Other comments about the PSTP or your training and career path since medical school?*

Of the 14 additional comments, 13 were praising the PSTP program. The one comment that was not an outright praise of the program discussed their residency program and their desire for it to be more supportive of research. One individual also mentioned that some of the questions in the survey were not relevant for them since they are in the early stages of their training.

Two key themes came out in the comments, demonstrated with quotes below.

#### 1. PSTP being unique among other institutions:

- “This program is a unique and impactful training opportunity at Pitt. Even when at conferences with HHMI med fellows, I recognized that our level of support and the breadth and rigor of our training was beyond what other medical training institutions offered. I hope that the University of Pittsburgh will continue to support the program to the greatest extent possible.”
- “I am grateful to be a part of the PSTP and the PSTP community. I appreciate the opportunity to conduct full-time research for one year with stipend support. This entire process has taught me much about mentor selection, hypothesis generation, literature review, grant writing, experimental design, data presentation, and statistical analysis. I am confident that the skills I gain during my time within the PSTP will prove beneficial when I apply for funding to support research projects during the rest of my career. Additionally, I would like to say that the PSTP is truly a unique program among medical schools. During my HHMI research year, I interacted with medical students from across the country. All of these students were very impressed with the level of support the PSTP provides its HHMI applicants, including the grant writing course, the paid summer lab rotations, and the offer to support 50% of the research year stipend. I also noticed that the PSTP is well regarded within the HHMI Medical Research Fellows Program administration. In conclusion, the PSTP is a phenomenal program that provides talented medical students interested in academic medicine with the tools and resources needed to succeed in their research endeavors.”

#### 2. General praise:



- “PSTP is an outstanding program. I decided to take a break from research since graduating from medical school but it has certainly given the foundation necessary to jump right back in. I now know what to look for in a mentor as well as a research question.”
- “Would certainly do it again. It has been extraordinarily valuable training in retrospect.”
- “The mentorship and structure of the PSTP was highly influential in my research during medical school and my grant writing skills which led to my HHMI med fellows award”

Of those submitting survey comments (Comments, Supplement) 44 of 45 respondents felt the PSTP to be helpful in their careers. Consistent with reported areas of confidence, with most comments identifying the following facets of the program as most useful:

- Developing and improving research skills
- Supporting career advancement opportunities
- Providing research opportunities to help generate scholarly output
- Mentoring
- Networking

## Supplemental Digital Appendix 5

### Modified Clinical Research Appraisal Inventory Used to Rate the Confidence of Students Who Have Participated in the Physician Scientist Training Program at the University of Pittsburgh School of Medicine

| Question   | Career Stage (mean, sd)              |                          |                         |              |
|--|--------------------------------------|--------------------------|-------------------------|--------------|
|  | 0=No confidence, 10=Total confidence |                          |                         |              |
|  | Med Students (n=25)                  | Residents/Fellows (n=19) | Finished Postgrad (n=7) | Total (n=51) |
| Write the results section of a research paper that clearly summarizes and describes the results, free of interpretative comments.        | 7.4 (1.8)                            | 8.1 (1.2)                | 8.0 (1.8)               | 7.7 (1.6)    |
| Write a discussion section for a research paper that articulates the importance of your findings relative to other studies in the field. | 6.6 (2.0)                            | 7.6 (1.4)                | 7.7 (1.9)               | 7.1 (1.8)    |
| Select a suitable topic area for study.  | 6.9 (2.1)                            | 6.7 (1.7)                | 7.9 (2.0)               | 6.9 (1.9)    |
| Identify faculty collaborators from within and outside the discipline who can offer guidance to the project.                             | 6.6 (1.8)                            | 7.1 (2.1)                | 7.7 (1.8)               | 6.9 (1.9)    |
| Arrange for constructive feedback on a grant proposal draft.   | 6.3 (1.7)                            | 6.6 (2.0)                | 7.1 (2.9)               | 6.5 (2.0)    |
| Draft a compelling specific aims page for a competitive grant.   | 6.2 (2.0)                            | 6.7 (1.6)                | 6.6 (2.3)               | 6.4 (1.9)    |
| Determine an adequate number of subjects/animals/repeats for your research project.  | 6.0 (2.1)                            | 5.3 (2.5)                | 6.0 (1.6)               | 5.7 (2.2)    |
| Describe a major funding agency's (e.g. NIH, NSF, or foundation) proposal review and award process.                                      | 4.3 (2.2)                            | 5.1 (2.0)                | 5.7 (2.1)               | 4.8 (2.1)    |

## Supplemental Digital Appendix 6

### Ranking, by Participants of the Physician Scientist Training Program at the University of Pittsburgh School of Medicine, of Factors Perceived as Facilitators (Table A) or Barriers (Table B) to Pursuing a Career as a Physician Scientist

| Table A: Facilitators   | Training stage (mean, standard deviation)                |                            |                            |                 |
|---|--|----------------------------|----------------------------|-----------------|
|   | 1 = Not at all influential,<br>5 = Extremely influential |                            |                            |                 |
|   | Med Student<br>(n=25)                                    | Resident/Fello<br>w (n=19) | Finished<br>Postgrad (n=7) | Total<br>(n=51) |
| Access to a role model who has been successful as a physician- scientist.                               | 4.6 (0.58)   | 4.6 (0.96)                 | 4.6 (0.53)                 | 4.6 (0.73)      |
| Identifying a research question and project that I am passionate about.                                 | 4.5 (0.59)   | 4.5 (0.51)                 | 4.7 (0.49)                 | 4.6 (0.54)      |
| Ability to find a mentor who can help develop my research skills.                                       | 4.6 (0.58)   | 4.3 (0.73)                 | 4.0 (0.82)                 | 4.4 (0.69)      |
| Having a department/division that is supportive of physician- scientist careers.                        | 4.4 (0.51)   | 4.4 (0.51)                 | 4.3 (0.76)                 | 4.4 (0.53)      |
| Having training in writing competitive grant applications.  | 4.5 (0.71)   | 4.3 (0.65)                 | 4.0 (1.00)                 | 4.3 (0.74)      |
| Completing a formal physician scientist training track during med school, residency, and/or fellowship. | 4.4 (0.77)   | 4.2 (0.69)                 | 4.3 (0.76)                 | 4.3 (0.73)      |
| Understanding what the career pathway looks like for becoming a physician- scientist.                   | 4.4 (0.65)   | 4.2 (0.76)                 | 4.1 (0.69)                 | 4.3 (0.70)      |
| Sufficient guaranteed protected time to conduct research as a clinician.                                | 4.2 (0.78)   | 4.4 (0.60)                 | 4.6 (0.53)                 | 4.3 (0.69)      |
| Ability to find a mentor who can offer advice for balancing professional and personal life.             | 4.0 (0.98)   | 4.3 (0.75)                 | 4.0 (0.82)                 | 4.1 (0.88)      |
| Having leadership skills and training to effectively run a research lab.                                | 4.1 (0.93)   | 3.7 (0.82)                 | 4.3 (0.49)                 | 4.0 (0.86)      |
| Having a network of potential collaborators.  | 4.0 (0.93)   | 3.9 (0.94)                 | 3.7 (0.76)                 | 3.9 (0.90)      |
| Feeling comfortable with my presentation skills.  | 3.8 (1.00)   | 3.6 (0.84)                 | 2.6 (1.27)                 | 3.5 (1.05)      |

| Table B: <b>Barriers</b>   | Training stage (mean, standard deviation)         |                            |                            |                 |
|--|---|----------------------------|----------------------------|-----------------|
|  | 1=Not at all influential, 5=Extremely influential |                            |                            |                 |
|  | Med Students<br>(n=25)                            | Resident/Fello<br>w (n=19) | Finished<br>Postgrad (n=7) | Total<br>(n=51) |
| Difficulty managing clinical responsibilities and research responsibilities.   | 4.1 (0.83)  | 4.0 (0.94)                 | 3.6 (0.98)                 | 4.0 (0.89)      |
| Difficulty obtaining funding.  | 3.8 (0.83)  | 4.2 (0.69)                 | 4.7 (0.49)                 | 4.0 (0.80)      |
| Difficulty managing personal life responsibilities (e.g. family, friends) and professional responsibilities as a physician- scientist. | 3.9 (1.19)  | 3.5 (1.07)                 | 3.4 (0.98)                 | 3.7 (1.12)      |
| Feeling unprepared to navigate the range of expertise needed to become an investigator.  | 3.6 (0.91)  | 3.4 (0.90)                 | 3.7 (0.95)                 | 3.5 (0.90)      |
| Managing the administrative burden associated with research careers.   | 3.8 (1.18)  | 3.11 (0.94)                | 2.9 (1.07)                 | 3.4 (1.14)      |
| Difficulty finding a mentor who has experience as a clinician and a researcher.  | 3.3 (0.90)  | 3.3 (0.87)                 | 3.6 (0.79)                 | 3.3 (0.86)      |
| Challenge of finding a niche in research.  | 3.1 (1.20)  | 3.2 (1.01)                 | 3.3 (1.25)                 | 3.2 (1.12)      |
| Having an unsupportive department/division for conducting research.  | 3.0 (1.27)  | 3.0 (1.15)                 | 3.7 (1.38)                 | 3.1 (1.24)      |
| Managing my student loan burden.   | 3.1 (1.42)  | 2.5 (1.50)                 | 3.6 (1.62)                 | 2.9 (1.50)      |
| Difficulty establishing a collaborative network.   | 3.1 (0.91)  | 2.9 (1.10)                 | 2.6 (0.79)                 | 2.9 (0.97)      |
| Unaware of what the career pathway looks like for a physician-scientist.   | 2.5 (1.16)  | 2.4 (0.98)                 | 2.7 (0.95)                 | 2.5 (1.05)      |
| Low interest in conducting research.   | 2.0 (1.29)  | 2.1 (1.10)                 | 2.4 (1.51)                 | 2.1 (1.24)      |