**Institutional Environment and Commitment to Training; Additional Educational Information**

Penn State is strongly committed to the training of physician-scientists throughout the 30-year history of its MSTP program. Currently under the leadership of Co-Directors Kirsteen Browning, Ph.D., and Leslie Parent, M.D., and Associate Directors Robert Levenson, Ph.D., Aron Lukacher, M.D./Ph.D., and Melissa Rolls, Ph.D., the mission of the Penn State MSTP program is to recruit motivated, diverse, experienced students and provide them with exceptional integrated clinical and research training in preparation for entering the physician scientist workforce. We have benefitted from strong institutional support which allows us to recruit 9 fully funded students per year.

Over the past several years, the Penn State College of Medicine (PSUCOM) has undergone a major expansion in facilities with the completion of the Penn State Cancer Institute and Children’s Hospital along with its recent three-story addition. Construction was completed on a 46,000-square-foot, $54 million Technology Center which provides centralized space and enhanced security for patient, research and educational data as well as the computing power for analyzing complex large data sets. This facilities expansion has been accompanied by the recruitment of >70 MD and MD/PhD physician-scientists into the junior and mid-level ranks, as well as into key positions, including Department Chairs in Medicine, Neurology, Pediatrics, Microbiology and Immunology, as well as the Cancer Center Director. These recruiting efforts aim to provide mentors and role models for MSTP students and increasing translational research at the COM. The research opportunities for MSTP students have also been enhanced by the addition of a cadre of excellent scientists at the University Park (UP) campus. We have established joint-degree programs with Engineering Sciences and Mechanics (ESM), Molecular and Cellular Integrated Biosciences (MCIBS), and the Anthropology graduate program, allowing MSTP students to perform their dissertation research in a wide variety of disciplines at UP. The success of the Penn State CTSI, a cross-campus, NIH-funded program, has played an important role in establishing effective and fruitful collaborations between investigators. Through workshops, seminars, training programs, and pilot project funding, the CTSI has strengthened bridges between MSTP training faculty members and students across the two campuses.

Andrew Sugarman completed his undergraduate training in Biochemistry at Oberlin College in 2019 and worked for a year as a Research Assistant in the lab of Dr Blanton Tolbert in the Department of Chemistry at Case Western Reserve University where he applied NMR and Small Angle X-ray Scattering technologies to investigate the structures or RNA and its interacting proteins, which resulted in 3 co-authored publications. Andrew matriculated into the MSTP program in 2020, and has completed his preclinical medical school curriculum and Step 1 of the USMLE. He entered the Biomedical Sciences graduate program in Fall 2022 and successfully passed his written and oral comprehensive exam in Summer 2023. He is co-mentored by Drs Justin Silverman (Assistant Professor of Statistics, Assistant Professor of Medicine) and Keith Cheng (Distinguished Professor, Department of Pathology and Laboratory Medicine, Department of Biochemistry and Molecular Biology, Department of Pharmacology & Penn State Cancer Institute), both of whom are MD PhDs, where is he working to adapt high resolution computer tomography to create 3-dimensional structures from biopsy images. Not only would this allow greater qualitative assessment of tissue biopsies but it would also permit quantitative analyses of tumor structures “in situ” within their broader anatomical framework. Andrew has continued to make stellar progress in his research studies, with a co-authored manuscript currently under review, and a co-first author manuscript in preparation, in addition to presentations at two national conferences. He has continued to refine his clinical skills by attending pediatric emergency room clinics with Dr Lilia Reyes, an Assistant Professor in the Departments of Pediatrics and Emergency Medicine and, given his interest in pursuing a residency in hematology/oncology, has also spent considerable time attending clinics with Dr Raymond Hohl, Director of the Penn State Cancer Institute.

The MSTP program currently matriculates 9 students and benefits from the active involvement of faculty members on a variety of levels, including as members of the Steering Committee, training faculty, interviewers, teachers, mentors, and dissertation advisors. The training faculty consists of 75 members, 50 in Hershey and 25 at the UP campus. Training faculty are selected based on several criteria including (i) adequate funding to support trainee stipend and tuition; (ii) proven track record in graduate training, especially MSTP students; (iii) excellence in research as judged by grant support and publication record; and (iv) excellence in mentorship. Junior faculty members may serve as research mentors if they have promising research potential, enthusiasm for training, and funds to support a student from extramural sources or departmental start-up funds.

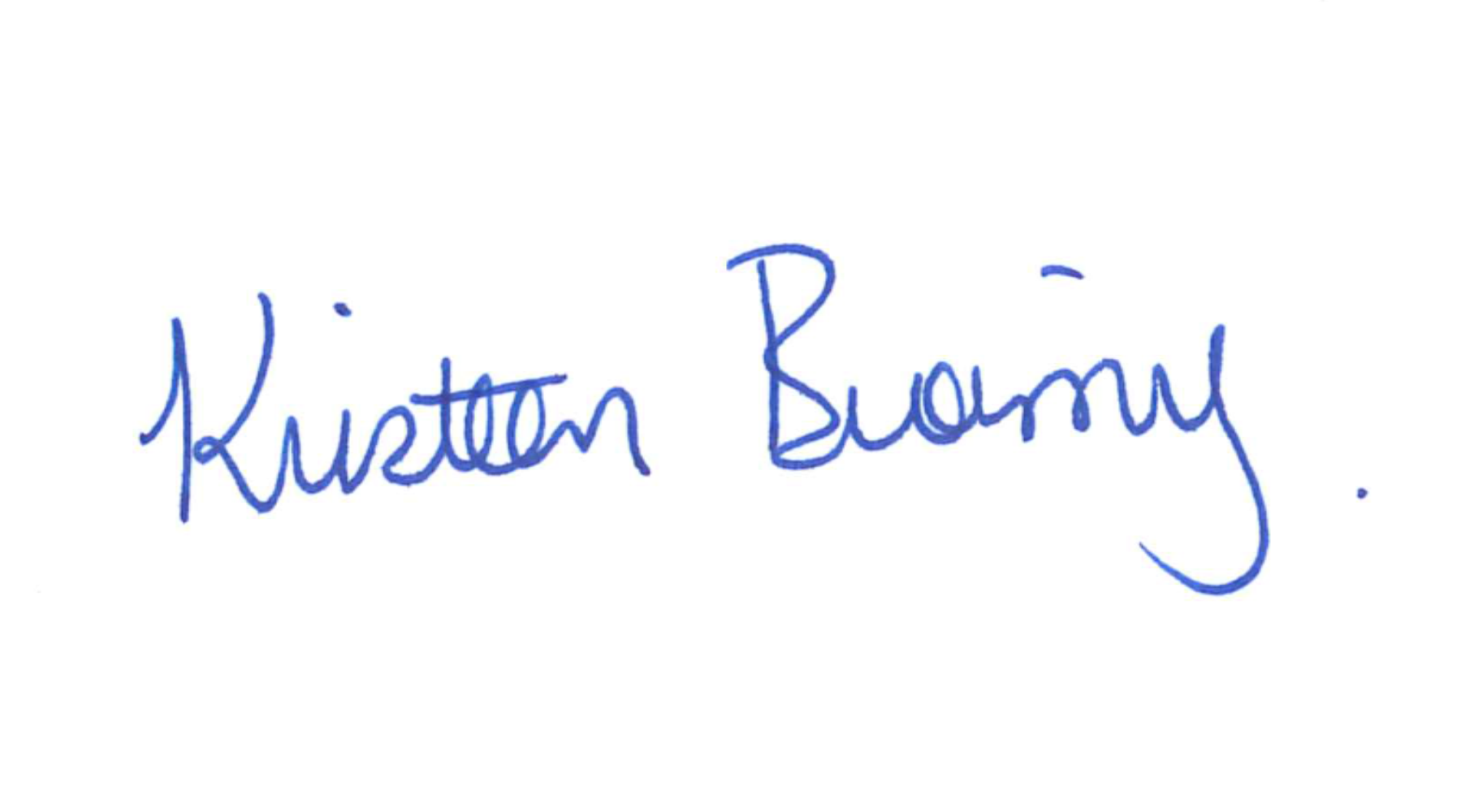
The MSTP program integrates medical and graduate education, providing flexibility for students to design a tailor-made educational experience that prepares them for their individual careers.  During the first two years of the program (M1-M2), students complete the preclinical medical education, which is organized around organ systems and consists of both lectures and case-driven problem-based learning (PBL) via small group discussions. Students also take several graduate courses during the first two years of medical school, and complete three research rotations. Students usually choose a research mentor shortly after completing the third research rotation and a graduate program that best suits their interests. At the end of M2, all students must pass the USMLE Step1 exam before they can begin the graduate phase of training. It is expected that students in the MSTP program will complete their research and dissertation defense within a 4-year period. Beginning with the fall semester of G2, students experience the life of a physician scientist with admixed research and clinical duties through our novel course, “Translational Research in Medicine” (BMS802). This course ensures ongoing clinical experiential learning and one-on-one training with a clinician scientist preceptor, providing an opportunity for students to build upon and hone their clinical skills while beginning to formulate a translational research project. To better align their clinical and research training after returning to medical school, MSTP students participate in a second course, “Advanced Translational Medicine” (MED797), a longitudinal clerkship during M3 in which students work one-on-one with a clinician scientist preceptor. This course provides students an opportunity to integrate their clinical and research training to address a medical problem observed in clinic. Throughout the program, students are exposed to topics in clinical, basic, and translational research via the monthly MSTP seminar series, the bimonthly Clinical Research Conference (CRC), and the annual MSTP retreat. The MSTP program requires that a student have at least one first-author, peer-reviewed manuscript accepted for publication, has successfully defend their PhD dissertation, and that the dissertation is submitted and approved by the graduate school, before progression to M3. All MSTP students are required to take “Transition to Clinical Medicine”, which reinforces the basic skills and knowledge a student needs to enter the clinical training years. MSTP students in the M3 and M4 years choose a Clinical Advisor who monitors the students’ progress through clerkships and advises students on applying for residency positions.

During their tenure in the program, MSTP students are required to attend the monthly seminar series where students give an annual oral presentation of their research project. Students also participate in the “Translational Research in Medicine” course during the graduate years and the “Advanced Translational Medicine” clerkship in M3. MSTP students also participate in the Clinical Research Conference (CRC), a bimonthly seminar series consisting of student presentations and discussions organized around a topic in Translational Medicine using a Case Study approach. For each CRC, a physician-scientist advisor guides students through a case study with presentations focusing on differential diagnosis, pathophysiology, and a scientific paper relevant to the study case. The MSTP program holds a two-day retreat in the spring of each year featuring invited speakers from prominent MD/PhD Programs or Physician-Scientist Training Programs (PSTPs) around the country. The retreat promotes vertical interactions amongst students, provides career development information, develops professional skills, and encourages scientific exchange and network building.

The MSTP leadership believes that individual mentoring of students is essential, and meetings with students throughout the year is a high priority. Career counseling is viewed as an ongoing, continual process. Formal meetings with the Co-Directors and/or Associate Directors are semi-annual, and more often if needed. We have implemented an overarching advising, mentoring, and career development plan that begins during orientation, continues throughout the medical and graduate years, and extends through graduation and beyond. To assist in this process, we utilize an Individual Development Plan (IDP) we specifically designed for our MSTP students which is reviewed annually with the Co-Directors and their other advisors.

The Office of Medical Education has worked closely with the Co-Directors to avoid scheduling conflicts with MSTP students when making changes to the curriculum or scheduling educational sessions. There is also flexibility in the timing (January through May) that students can reenter medical school and begin clinical rotations. Finally, the Clerkship Directors have demonstrated flexibility and support for the program by allowing MSTP students flex time so they may attend program specific events such as the MSTP seminar and CRC conference. These multiple types of commitments have helped to create a vibrant and supportive academic environment in which the training of future physician-scientists represents a top priority at Penn State.

Andrew Sugarman has performed at a very high level since matriculating in the Penn State MSTP. He has is on-track to complete his PhD in Fall 2025, return to medical school in Spring 2026, and graduate from the MSTP program in May of 2028. We anticipate he will continue to both make noteworthy progress and discoveries in his research studies and grow as a talented physician-scientist.

Information prepared by Kirsteen N Browning

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