

Bedside to Bench

Basic Science Research During General Surgery Residency

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Clinical, basic science, and quality improvement research is becoming increasingly integrated into general surgery residency programs, providing aspiring surgeons with an avenue to engage with academia and improve patient care early on in their careers. For example, as an essential part of their training, general surgery residents at Thomas Jefferson University Hospital (TJUH) complete one to two years of research, usually between their PGY3 and PGY4 years. The goal of this protected research time is for residents to gain hands-on surgical research skills and work on translational research projects that correlate with clinical cases, while also becoming more competitive for fellowship program applications. During their research years, residents attend bi-weekly seminars that feature research-in-progress presentations by their peers, as well as lectures on refining study design, statistical analysis, or grant-writing skills. To establish their academic careers, residents are encouraged to submit conference abstracts, publications, and grant applications, and to collaborate with other researchers at TJUH or at outside institutions. Every spring, the Division of Surgical Research, led by Dr. Jonathan Brody, hosts a Resident Research Day where residents present the culmination of their scholarly activity prior to returning to the hospital as fourth years. The research year at TJUH allows residents to use their clinical knowledge and experiences to further the greater medical community's understanding of surgical procedures and stimulate innovation in the field.

TJUH offers a plethora of clinical and basic science research opportunities to general surgery residents, many of which correlate with surgical subspecialties. Previous projects have focused on the effectiveness of multimodal treatments for pancreatic cancer, patient outcomes following gastric bypass surgery, the pathobiology of vascular disease, and the prevention of post-operative complications such as deep vein thrombosis and septic shock, to name a few. Within the current general surgery research year cohort, two residents, Alicja Zalewski, MD and Peter Altshuler, MD, chose to pursue translational

basic science research. Dr. Zalewski is working in the Scott Waldman lab at Thomas Jefferson University, where she has been learning how to isolate colorectal cancer stem cells from patient tumors. Her next experiments will include growing the stem cells in culture and in mice, treating them with immunotherapy, and evaluating tumor growth.

Dr. Altshuler is studying mechanisms to downregulate ischemia/reperfusion injury during revascularization post-myocardial infarction with Dr. Pavan Atluri at the University of Pennsylvania. In particular, he is interested in quantifying the degree of injury caused by an initial ischemic event compared to the additional insult that results from reperfusion.

Both residents worked in basic science labs prior to starting residency and consider these experiences formative in their decision to conduct bench work, rather than clinical research. During her combined seven-year BA/MD program at The College of New Jersey and Rutgers New Jersey Medical School at Newark, Dr. Zalewski worked in a chemistry lab for two years. While



Peter Altshuler, MD

this was a valuable introduction to the scientific method, she was eager to seek out additional opportunities to work on translational projects that could potentially inform clinical practice guidelines. As an undergraduate and Master's student at the University of Michigan, Dr. Altshuler worked with Dr. Bishr Omary researching cytoskeletal rearrangement during liver injury; there, he built a foundation in basic science that made it easier to step into the research year of surgical residency. Both residents expressed that the integrated research year and the availability of research projects drew them to TJUH as it signaled an emphasis on training well-rounded surgeons who are given an opportunity to explore their individual interests in the field.

Both residents have experienced challenges during the research year: picking up new unfamiliar jargon, learning to patiently await the results of a days-long experiment, and persisting when data collection doesn't go as planned. After three years of clinical residency training, Dr. Zalewski felt confident in the operating room and outpatient clinic, communicating with her surgical team and running consults. Being in the lab every day was a welcome change of pace, however she noticed that she was "like an intern again, learning everything from the ground up." Despite the steep learning curve, Dr. Zalewski considers her research year to be an important contribution to her training and her appreciation of evidence-based medicine. Over the past few months, she has learned the minutiae of new biomolecular techniques and how to design experiments with appropriate controls. Furthermore, she is able to approach scientific literature papers and data critically, while practicing her own writing and presentation skills. Similarly, Dr. Altshuler feels that, as a surgeon, he has been trained to think pragmatically; generating scientific hypotheses in the lab has allowed him to practice his theoretical and creative problem-solving, competencies he considers integral to addressing gaps in patient care. Dr. Zalewski and Dr. Altshuler agree that, compared to clinical research, basic science research requires more dedicated time and has a lower guarantee of success, especially given the relatively short timeframe of the research year. However, the prospect of publishing high quality data that significantly contributes to their respective fields and promotes further translational research is extremely rewarding. Working in the lab has also involved a shift in work-life balance as compared to the clinical years. The ability to dictate one's own hours has allowed both residents to reconnect with family and friends, and to commit more time to their personal lives. Dr. Zalewski has especially enjoyed getting to further know other residents in the program at their monthly



Alicja Zalewski, MD

'family dinners'.

It is unclear what role basic science research will play in Dr. Zalewski's and Dr. Altshuler's careers post-residency. While neither resident currently foresees starting their own wet labs, they expect to use the knowledge and technical proficiency gained this year during their fellowship training and beyond. As an attending, Dr. Zalewski hopes to teach her residents to value data-driven clinical practice and to be analytical of accepted protocols and guidelines. Ultimately, she feels that translational research should be bedside to bench, driven by improving patient outcomes and quality of life. Dr. Altshuler agrees that clinician-scientists are uniquely positioned to generate high-yield scientific questions that bridge the gap between the patient experience and the basic science research lab. In terms of which students would be best suited to pursue basic science research during or before residency training, both residents offered similar advice: while all students would benefit from learning how to ask clinically relevant and innovative clinical or basic science research questions and learning a different way of thinking, Dr. Altshuler notes that "just as students have the choice to pursue the specialty that excites them most, they should also pursue research in the same fashion," guided by genuine interest and excitement for their project.