"RESEARCH IS FORMALIZED CURIOSITY; IT IS POKING AND PRYING WITH A PURPOSE."

Case Studies: Five Students and Their Scholarly Projects

As American folklorist and writer Zora Neale Hurston once said, "Research is formalized curiosity; it is poking and prying with a purpose." For Pitt medical students since 2004, part of that purpose is to meet a new curricular requirement, which affords them considerable latitude for formulating a mentored scholarly project that meets their personal interests. However, all the projects share a common goal, which is to help them become better physicians. Here are examples of the projects being developed by members of the Class of 2008, the first one required to partake in this "formalized curiosity" process.

BECOMING BETTER DOCTORS

Why, you might ask, is having more than a passing familiarity with research so important in medical education and in the practice of today's medicine? And why do we feel so strongly about this issue that we have woven a scholarly project into our curriculum and made it an integral component of every medical student's experience here? The simple answer is tied to the never-ending quest for excellence in the education of would-be physicians. However, simple answers don't tell the full story, which, in this case, is perhaps best approached from the bottom line: What kind of doctor do you want?

Our thinking is that physicians schooled in the analytic process are better prepared than those without such a background to retrieve and critically evaluate the information in this week's *JAMA* and *New England Journal of Medicine*—information that can help them determine patient treatments, for instance, or separate advertising hype from established facts in the process of evaluating new drugs.

We believe that physicians schooled in the analytic process will listen to a patient's medical history and complaints differently. Rather than starting with a set of memorized characteristics and trying to fit the patient into one pathogenic category or another, they listen to all the facts the patient provides and put them together anew. Even if the outcome turns out to be familiar, the realm of diagnostic possibilities is much broader and the practice of medicine much richer than when it is based simply on rote recognition of symptom patterns.

We also contend that physicians schooled in the analytic process are more likely than others to get to the bottom of a case and to yield creative clinical decisions based on solid evidence when symptoms don't fall into common patterns and that they'll be better equipped to deal with the rapidly changing developments that have become a hallmark of contemporary medicine.

So, once again, what kind of doctor do you want?

Beginning with the Class of 2008, which started medical school in 2004, a scholarly project has been incorporated longitudinally throughout our curriculum and has been broadly defined to provide a wide range of opportunities to appeal to individual students' interests and aspirations.

Some students select traditional laboratory-based or clinical research experiences, while others opt for less obvious choices. The goal in every case, however, is to enhance their ability to think independently and critically and, thereby, become better equipped to practice medicine in the 21st century.

This goal is achieved initially through course work designed to teach the fundamentals of deductive reasoning and analytic thought in the application of scientific principles, followed by the establishment of a working relationship with a faculty mentor, whose role is to advise and guide the student throughout the process.

The intent is to expose students to the mechanics of scientific investigation; teach them how to develop a hypothesis and how to collect, analyze, and interpret data to support that hypothesis; encourage them to pursue research opportunities; and, ultimately, help them better understand the structure of thought underlying the practice of medicine.

In the end, as a requisite for graduation, they are expected to produce a scholarly project that is deemed to be sufficiently meritorious and substantive. Some students might find the experience so rewarding that they pursue a career as a physician-scientist—the decline in the number of which has become an issue of growing concern for the future of biomedical research. Others will simply develop a better appreciation for what it is to do research and engage in scholarly activity, with the result that they become more capable and skillful physicians.

While a limited number of other medical schools have incorporated similar research projects into their programs, our scholarly project differs in several significant respects. One hallmark is the thoroughness with which we prepare students to undertake a scholarly project, regardless of whether it involves basic or clinical research, population-based research, or a nontraditional endeavor. Our curriculum leads students through a sequence of courses, examples, and creative implementation steps as well as practice in scientific writing to give them the skills needed to successfully conduct scholarly work.

This preparation is particularly important because today's medical students matriculate from a broader array of backgrounds and experiences than in generations past, and so they might not have been previously exposed to the basic tools of scientific inquiry. By integrating mandatory didactic components of the program throughout the curriculum, we can maximize the benefits of this experience. Further, the mandatory aspect of the scholarly project doesn't make it unique but certainly among the more exclusive programs now being offered.

Finally, regular, periodic checkpoints of students' progress throughout the four-year process, an emphasis on developing strong faculty mentors to ensure the program's ongoing success, and creative use of electronic technology to foster learning and mentorship are among its other distinctive elements.

The scholarly project represents a novel (and perhaps even prototypical) way to increase the number of medical students who pursue research-based careers or clinical careers grounded in evidence-based medicine—and those are the kinds of doctors we want.

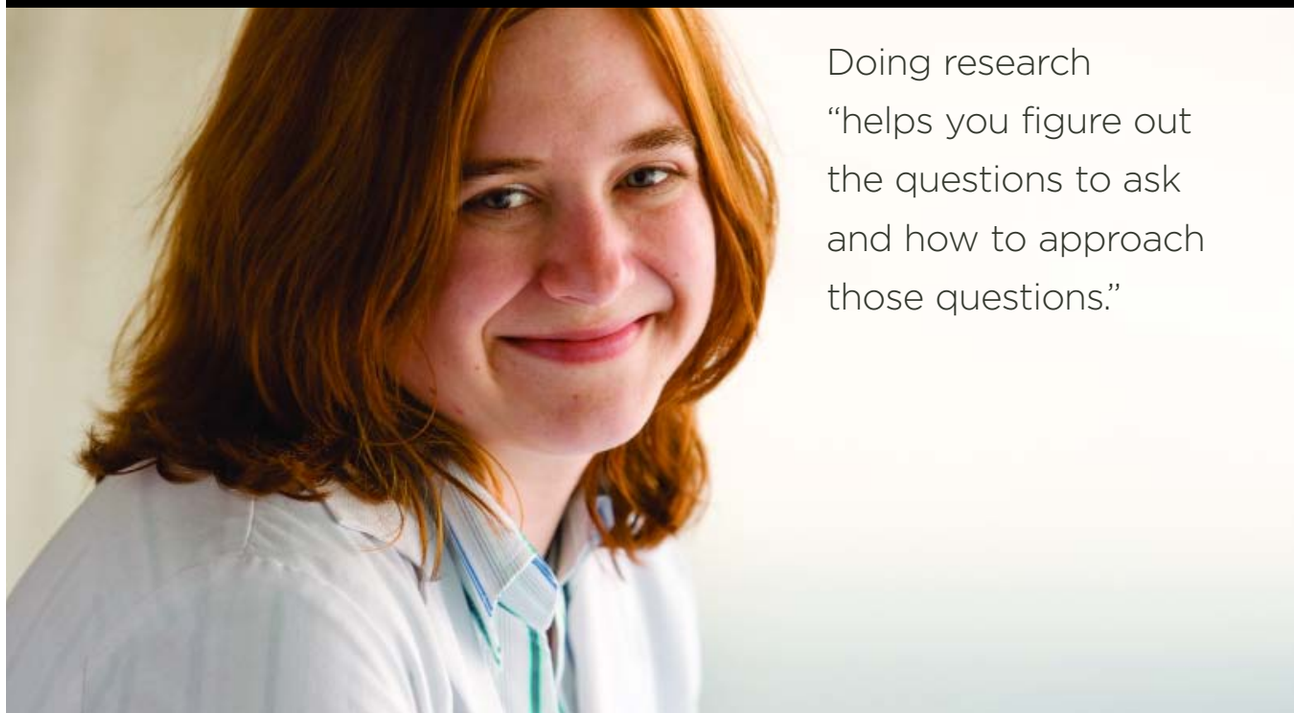
Kristin Robbins

To create a better vaccine, "you have to start somewhere," Kristin Robbins says, and that means dealing with basic science, which she enjoys. "I kind of like getting in on the groundwork," says Kristin, who has a degree in genetics from the University of California, Davis, and experience working in a biosecurity lab at the Lawrence Livermore National Laboratory. With that background, it's easy to see why hardtack science would interest her and how that interest would influence her selection of a scholarly project.

Under the mentorship of Gerard J. Nau, M.D., Ph.D., an immunologist with expertise in infectious disease, Kristin is exploring how to develop a more effective vaccine against tularemia, a relatively uncommon but highly infectious and easily spread bacterial disease. Spurring her interest are the dual facts that tularemia's virulent properties make it a potential biological weapon and that the current vaccine made from a live strain of the disease's pathogen, *Francisella tularensis*, is not approved for widespread use in the U.S.

Kristin's hypothesis is that a safer, more effective vaccine can be developed by exporting immunogenic proteins from the bacterium to create a more potent immune response. The process of testing her hypothesis has begun; "I should have the results from at least one immunogenic protein by the end of this year," she reported in early 2007.

Kristin admits to having "a fondness for research" but hasn't determined how much a part of her career it will be. Doing research "helps you figure out the questions to ask and how to approach those questions," she says, adding that it parallels somewhat the experience of a clinician who faces a challenging case and must go about trying to solve it; the skill set is similar. Not only that, she says, but research is essential to clinical medicine. "It's important to have research in order to move forward and continue to develop the kind of treatments that the public expects from us."



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Brian Dontchos

Before Brian Dontchos came to medical school, he spent two years in a job harvesting cartilage allografts from cadavers for organ donation. In doing so, he learned how sensitive chondrocytes, or cartilage cells, can be.

The allografts must be captured within 48 hours of death and kept cold for up to two or three weeks to prevent bacteria growth while donor screening and microbiological cultures are performed to ensure the safety of the recipient. However, studies have shown that cold can diminish the chondrocytes' viability.

Another variable, which has not been explored as much, is the pH of the solution in which the allografts are stored pending transplantation. So, when Brian, who has a biology degree from the University of Denver but little background in biomedical research, needed a topic for his scholarly project, he drew on his work experience, and, with the help of Constance R. Chu, M.D., orthopaedic surgeon and mentor, he designed a study titled "Enhancing Human Chondrocyte Viability."

What he found and subsequently reported in an article submitted to the *Journal of Orthopaedic Research* is that adding CO_2 to the solution can provide the pH levels that the cartilage cells require; alternatively, he determined that using storage media that maintain the requisite pH can also work.

Admittedly reluctant at first about the scholarly project requirement, Brian says it turned out to be a positive experience: "I was actually excited about it when I first came up with the idea and my mentor was willing to help." In caring for patients with wide-ranging problems during his clinical rotations, Brian says he has learned that physicians must be able to think critically, develop a plan of action, and solve the unknown—all of which are skills that doing research can engender.

Amanda Christini

Amanda Christini is puzzled why all health care workers aren't willingly immunized against influenza each year. The reality is that only about 40 percent of them are vaccinated, according to nationwide studies, which have documented the dangers of nosocomial transmission of the flu, especially to high-risk hospital patients.

Based on nearly 10 years of experience working in the biotech arena, most recently in business development of vaccines and immunotherapy, Amanda brought an interest in the topic with her to medical school along with a biology degree from Tufts University. Her mentor, Karin E. Byers, M.D., an infectious diseases specialist, helped her formulate the focus of her scholarly project, which is designed to gauge vaccination rates and motivating factors among various groups of health care workers.

The study involves 1,042 workers at UPMC Presbyterian, UPMC Shadyside, and Children's Hospital of Pittsburgh of UPMC. The results, as published in *Infection Control and Hospital Epidemiology*, show that the groups of health care workers with the most patient contact are the least likely to be vaccinated and that approximately half of the health care workers have come to work with flu-like symptoms.

To boost compliance rates among various groups of health care workers, the report suggests educational initiatives targeting the benefits of immunization as well as ways to counter prevailing misconceptions. "What you really have to do is win people over," Amanda says.

She notes that today's medical students recognize the importance of research experience to be competitive in their residency applications. "It's actually nice that there's a formal structure now that can support people to do the work they need to do anyway and would have done on their own," she says, adding that coming from an institution with such a high reputation in research gives Pitt medical students clout as they approach the next phase of their education.

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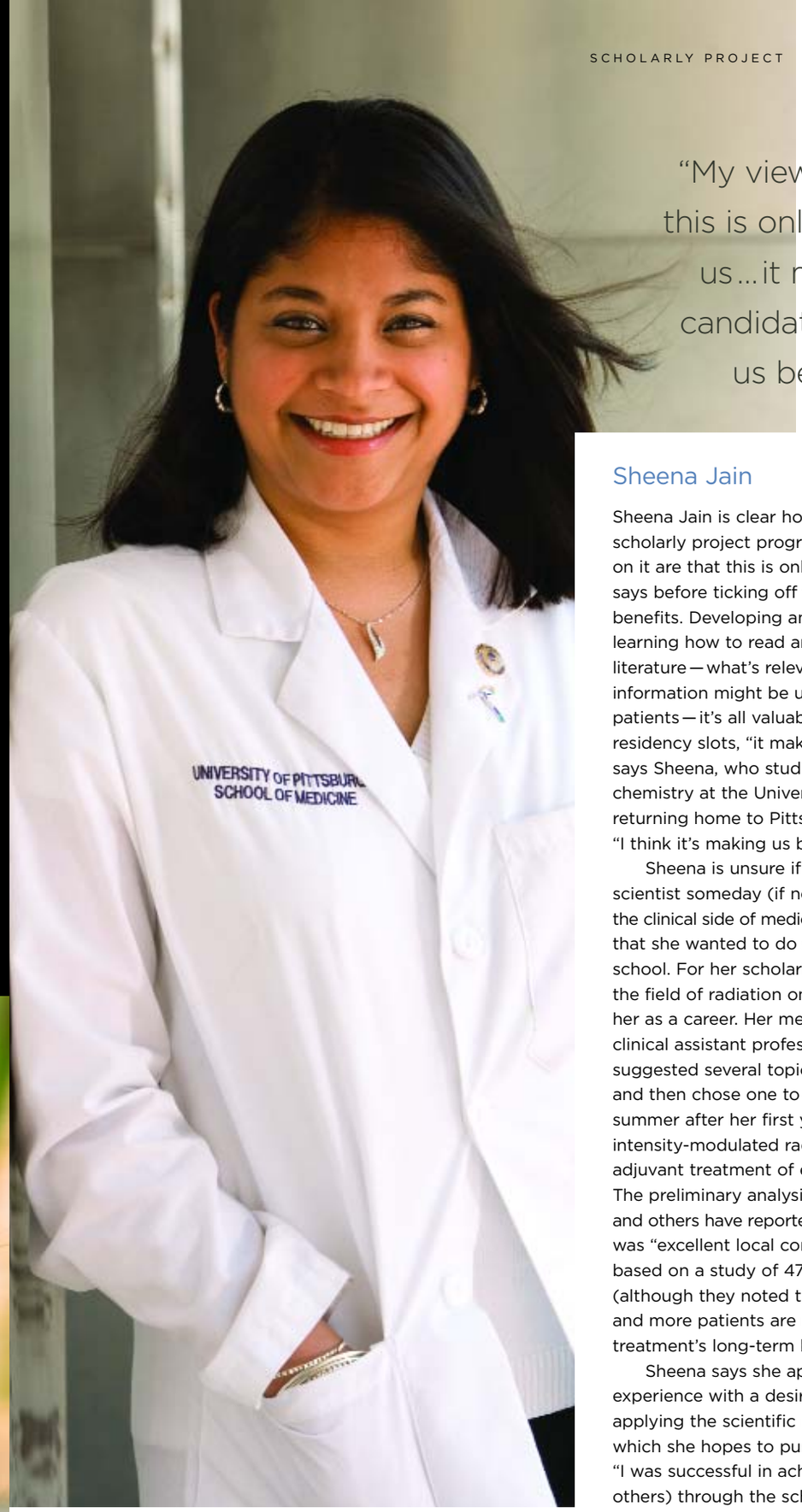
Yvette Tanhehco

Yvette Tanhehco came to medical school with a Ph.D. in biochemistry and cellular and molecular biology from Johns Hopkins University and considerable research experience in viral oncology. She wonders if the time she must devote to a required scholarly project might not, in her case, be used differently; but with lemons-into-lemonade optimism, she admits to seeing the benefits of the experience.

Yvette's project is based on the premise that individuals with Down syndrome experience obstructive coronary artery disease less often and have a lower mortality rate from atherosclerotic cardiovascular disease than the general population. What she's doing in her project, with guidance from cardiologist Steven E. Reis, M.D., her mentor, is comparing serologic markers of angiogenesis, inflammation, and endothelial activation as well as atherosclerotic risk factors like lipids and glucose in two groups of adults, one with and the other without Down syndrome, to determine whether the levels of the markers differ. Yvette says the ultimate benefit, which lies beyond the limited scope of her project, would be the insight to develop new therapies to better protect the general population against coronary artery disease and atherosclerosis.

Unlike the basic science with which Yvette is most familiar, this project allows her to explore something new: clinical research, which means learning to conduct a clinical trial, write an Institutional Review Board application, recruit subjects, collaborate with physicians, and follow the research protocol—all of which she sees as pluses. Yvette adds, "I think there's a benefit to making students do research, to having a scholarly project, because it allows you to think creatively, and that's the main reason I love research."



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Sheena Jain

Sheena Jain is clear how she feels about the scholarly project program. "Personally, my views on it are that this is only going to help us," she says before ticking off what she sees as its benefits. Developing and testing a hypothesis, learning how to read and critically assess the literature—what's relevant, what's not, and what information might be useful in dealing with patients—it's all valuable. And in competing for residency slots, "it makes us better candidates," says Sheena, who studied chemistry and biochemistry at the University of Virginia before returning home to Pittsburgh for medical school. "I think it's making us better physicians."

Sheena is unsure if she'll become a physician-scientist someday (if not, it's because she likes the clinical side of medicine so much), but she knew that she wanted to do some research in medical school. For her scholarly project, Sheena chose the field of radiation oncology, which interests her as a career. Her mentor, Sushil Beriwal, M.D., a clinical assistant professor of radiation oncology, suggested several topics, which she read about and then chose one to tackle beginning the summer after her first year: an assessment of intensity-modulated radiation therapy (IMRT) as adjuvant treatment of endometrial carcinoma. The preliminary analysis, as Sheena, her mentor, and others have reported in *Gynecologic Oncology*, was "excellent local control and low toxicity" based on a study of 47 patients treated with IMRT (although they noted that longer follow-up and more patients are needed to ascertain the treatment's long-term benefits).

Sheena says she approached this research experience with a desire to learn more about applying the scientific method to the field in which she hopes to pursue her clinical training. "I was successful in achieving that goal (and others) through the scholarly project program, so I'm grateful to have had that opportunity here at Pitt."