MEDICAL SCIENCE EDUCATOR
The Journal of the International Association of Medical Science Educators
Med Sci Educ 2013; 23(1S): 84-87

SHORT COMMUNICATIONS

Integration of the Medical College of Wisconsin Physician Scientist Pathway and Summer Research Programs to Increase Medical Student Research Skills

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Abstract
The Physician Scientist Pathway provides students with protected curriculum time for research. A structured program during first year teaches introductory research skills and prepares the student for an intensive summer research experience. Dedicated time during second and third year focuses on the dissemination of results in oral and written form.

Background
There has been a decrease in the number of physicians pursuing research careers.[1,2] Programs to increase research skill development have been developed by the National Institutes of Health (e.g. career development awards) and others to combat this decline and increase physician research. Training has also shifted to earlier periods, with residencies and medical schools encouraging research. During residency, one of the obstacles to successful research has been the fact that most residents arrive with no research experience.[3] Medical schools have developed areas of concentration or "selected student components" to help start research careers in medical school with the hope that those programs will translate to increased numbers of physician scientists in the future.[4-6]

Here we describe the Medical College of Wisconsin's approach to improving student research skills and experience by integrating an established summer research program with a newer Physician Scientist pathway.

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Medical College of Wisconsin
The Medical College of Wisconsin instituted a mandatory Pathways program in 2009. All students are required to participate, but may choose from one of five current options (Clinician Educator, Global Health, Quality Improvement and Patient Safety, Physician Scientist, and Urban and Community Health). By combining the Physician Scientist pathway with an elective research experience during the summer after the first year of medical school, students are provided a longitudinal research experience beginning early in the first year and continuing throughout medical school. This novel integration builds on a well-established summer research program, integrating required curricular activities developed as part of a scholarly pathway program, now in its fourth year. Participation in both the Physician Scientist pathway and Medical Student Summer Research Program (MSSRP) has increased since the integration, enabling a more rigorous research experience.

Scholarly Pathways
The Scholarly Pathways program at the Medical College of Wisconsin (MCW) enables students to individualize an aspect of their curriculum, while exploring a career path of interest. Scholarly pathway time for first, second and third year medical students is built into the curriculum, with one half-day per week allotted for pathway

activities. Participation is mandatory, but the student selects the pathway that best matches his/her career goals. Students who wish to pursue research training through the completion of a mentored research project select the Physician Scientist pathway and begin their development towards a career as a clinician scientist in the first year of medical school.

The structure of the Physician Scientist pathway combines monthly core sessions with weekly noncore time for students to work on research related activities. The monthly core sessions are a combination of large and small group activities. Large group activities are primarily focused on learning core competencies. Core topics are described in Table 1; topics in the first year focus on preparation for summer research, while jointly held second and third year sessions focus on dissemination of results from the summer project. As the third year is longer than the second year in length, sessions specific to third years were developed and include: how to discuss your research during the residency match process (session taught by fourth year former Physician Scientist students) and preparing for research in residency (taught by successful resident researchers).

Each monthly core session has a small group activity which allows for peer mentoring as well as interactions with faculty facilitators. Groups of eight to ten first year students meet with one or two faculty facilitators and two third year Physician Scientist students. These groups, which remain intact for the entire year, meet monthly. The students practice the skills discussed in the large group session with more experienced students critiquing work and discussing strategies for preparing for the summer. Second and third year students have additional small groups with faculty facilitators; their goal is the completion of data collection/analysis and dissemination of results in manuscript form, with the student as either primary author or co-author. Small group activities during these two years are focused on student presentations and feedback concerning progress.

First Year	Second/Third Year	Specific to Third Year[2]
Research Ethics (Including on-line certification)	Abstract writing and review	Research in residency sessions[3]
Developing a research question	Poster development and presentation	Emphasizing scholarly work in the residency match process[4]
Conducting a literature search	Manuscript writing	
Introduction to bibliographic software	Critical review of manuscripts	
Authorship criteria (Including discussion of authorship with preceptor)	Journal review process	
Evaluation of oral abstract presentations[1]	Scoring abstracts for national presentation	
	Evaluation of oral abstract presentations	

Table 1: Core session topics during three year Physician Scientist pathway
[1] In an interactive audience response session
[2]Additional sessions specific to third year of medical school are required due to additional months in the third year.
[3]Led by residents conducting research.
[4]Led by Fourth year medical students who were in the Physician Scientist pathway

In addition to the monthly core sessions, students are required to spend a minimum of six hours per month working on their research projects. While six hours per month is insufficient to complete a research project, it does allow for preparation before a project, study training, meetings with mentors, and continuation of an established project. Six hours per month is a minimum, with some students documenting hundreds of hours of work dedicated to a research project during the school year.

Obviously, program success depends on faculty effort, as project mentors, small group facilitators, and large group presenters. Students select summer preceptors from a frequently updated website, listing projects and faculty investigators who indicate they prefer working with a student integrating the MSSRP and pathway noncore time. The list is updated by polling faculty with a track record of successful mentorship and by emailing newer faculty to encourage participation. Most of the faculty have extensive experience with the MSSRP and are learning to improve the experience through integration with the Physician Scientist pathway. During the school year, students document their project related activities and hours in the medical school learning system, with guidance from a Pathway coordinator, shared between multiple pathways, who also serves as the primary contact for pathway related questions. At the midpoint and conclusion of each year, the faculty member approves the hours and activities of the student and assesses progress on project completion. Faculty, most of whom also serve as research mentors, also serve as facilitators for the small groups, dedicating one hour per month to small group sessions plus facilitating pre-work for the sessions. Faculty presenters for core sessions are not required to be small group facilitators but some serve in that role as well. A few faculty serve as mentors, facilitators and large group presenters.

The Physician Scientist pathway functions best when integrated with the Medical Student Summer Research Program (MSSRP). Students select a pathway advisor who also functions as their summer research preceptor. Together they either develop a project or decide on one of the mentor's projects that will become the student's project. Students use pathway noncore time completing background reading related to the summer project, spending time in the preceptor's lab, learning techniques and becoming familiar with research staff and procedures.

Medical Student Summer Research Program (MSSRP)

The MSSRP is an elective, academic enrichment program designed to expose medical students to research and careers in biomedical research. The program provides rigorous, hands-on, fundamental research experiences within the translational research laboratories of funded MCW investigators. It facilitates opportunities to participate in new discoveries and learn how research findings are translated into the clinical arena.

Students in the MSSRP complete an eight to 12 week intensive research experience in the lab of research faculty. Funding for students is based on a competitive application process, with money available from NIH grants (e.g. National Heart, Lung and Blood Institute, National Institute on Aging), Department funds, and from charitable giving. Some students choose to participate without funding.

Students who participate in the MSSRP are required to prepare an abstract and present a poster describing their research findings. The poster session is attended by all students in the program, the majority of first year students looking for research preceptors and a large number of faculty interested in research conducted by summer students. Critical review of the abstracts and posters is provided during small group sessions in the pathway early in the second year, as described above.

Successful students are invited to participate in third and fourth year research electives to extend their research. An Honors in Research program, requiring 16 weeks of research and a written thesis, provides further incentive for successful research completion.

Impact of the integration of the two programs

We are tracking the impact of the program through participation, evaluation, and productivity. Participation in both programs has increased since the integration has been implemented. Enrollment in the Physician Scientist pathway increased from approximately 50 students/year to almost 90 for the current year, with the number of students applying for the MSSRP increasing from approximately 75 students to over 110 students from a class size of approximately 210. Greater than 90% of students in the Physician Scientist pathway participate in the MSSRP. Physician Scientist Evaluations, completed

at the end of every year and primarily Likert scale questions, revealed that approximately 90% of students believed the Physician Scientist pathway enhanced their growth as physicians and allowed them to demonstrate curiosity resulting in evidence-based critical thinking. As the integration of the programs is still early, we do not have productivity information. However, we are tracking publications, national and regional presentations and the number of students who pursue research electives to document changes resulting from the novel integration of the Physician Scientist pathway and the long-standing Medical Student Summer Research Program. While the program has been highly successful, there are aspects that can present difficulties. Both student and faculty expectations occasionally need to be managed, as students are very busy academically during the school year and faculty may not see the level of progress they want. Students may also decide that they no longer wish to continue working on the project at the conclusion of the MSSRP. In both instances, improved communication between the student and faculty preceptor, sometimes with Pathway Director help, usually resolves the problem. Students are assisted in finding an alternate project should that be necessary.

In conclusion, combining the Physician Scientist pathway with the Medical Student Summer Research Program allows students to develop the basic research skills required to continue research throughout their careers. The continued success of this program will help train the next generation of researchers in an era when time for research skill development is becoming more difficult to protect.

Key Words
Research, medical student

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