



REVIEW ARTICLE

Academic pipeline initiatives in pediatrics

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Steve Abman (SA): We welcome you to the next of our joint APS-SPR Virtual Chat series on “Challenges in Pediatric Academic Medicine.” The goals of this series are to provide a forum to bring together diverse members of our academic community across the academic lifespan, including students and residents, fellows, and faculty, as well as senior leadership, to address critical issues regarding career development and related topics. Today’s session is entitled, “Enhancing academic careers throughout the pipeline,” which integrates many key topics that are central for attracting, developing, and sustaining successful academic physicians and physician-scientists.

For today’s discussion, we have an outstanding panel. First, I am pleased to welcome Dr. Catherine Gordon, who holds the Robert P. Masland, Jr. Chair and Chief of Adolescent Medicine, and is Director of the Bone Health Program at the Boston Children’s Hospital and Medical School. Trained in adolescent medicine and endocrinology, her outstanding work bridges both disciplines. Dr. Gordon is especially recognized for her mentorship and skills in developing career development and research programs for young investigators, especially through her great understanding of how to enhance one’s academic development across the pipeline. She also has a special interest in supporting junior investigators who are women and/or underrepresented in medicine.

Our second panelist is Dr. Peggy Hostetter, who just completed an outstanding tenure as the BK Rachford Professor and Chair of the Department of Pediatrics and Chief Medical Officer at Cincinnati Children’s Medical Center, and Director of the Cincinnati Children’s Research Foundation. She currently serves as the special advisor to the CEO at Cincinnati Children’s Hospital Medical Center. Dr. Hostetter has been a leader in so many aspects of academic medicine throughout her remarkable career. Her high level of scholarship has been reflected by her many contributions in the field of immunology and infectious disease, especially as related to fungal diseases. She has been recognized nationally for her development and remarkable success of the Pediatric Scientist Development Program as PI, reflecting her skills and insights in mentorship, career development, and navigating the academic pipeline. She has further served as past President of both the APS and SPR, as well as playing key leadership roles in many other national organizations.

Our third panelist is Dr. Michael DeBaun, who is the JC Peterson Endowed Chair and Professor of Pediatrics and Medicine at Vanderbilt University. He is the Vice Chair of Clinical and Translational Research in the Department of Pediatrics, and importantly, the founder of the Vanderbilt Meharry Sickle Cell Center of Excellence. Michael is an internationally renowned clinician-scientist whose research has led to breakthroughs in the management of sickle cell disease in children and adults. He has

been a strong advocate and has established new programs and networks for improving our care and research in children and adults with sickle cell disease. His contributions to medicine are reflected by numerous awards, including the Ernest Butler Prize in Lecture Clinical Science from the American Society of Hematology (ASH), the Maureen Andrews Award for mentorship from the SPR, and the ASH Clinical Science Research Mentor award. Most recently, he was honored by Stanford University as the recipient of the Lifetime Achievement Award.

In addition to our outstanding panelists, I welcome Dr. Stephanie Davis, the Chair of Pediatrics at the University of North Carolina and President of the SPR.

Stephanie Davis (SD): We are excited about today’s virtual chat, entitled “Enhancing Academic Careers throughout the Pipeline.” I would like to thank Drs. Gordon, Hostetter, and DeBaun for speaking today. We will start with Dr. Gordon.

Catherine Gordon (CG): Thank you so much for that nice introduction. It is truly an honor to be here with my two esteemed panelists, Dr. Hostetter and Dr. DeBaun.

To start the session this afternoon in thinking about the pipeline, I would like to share a personal experience. It all started when I was a medical student at UNC Chapel Hill. I had the exhilarating experience of working in a basic science lab, and after my second year, I had the opportunity to take time out from the regular curriculum and work with a hematologist-oncologist. I wrote an application for a T35 grant, which was funded, starting my career with the impression that NIH grants were easy to obtain! Actually, I later learned that it’s a bit more challenging, but it was an impressionable time in my career and I had a fantastic experience and mentor.

That early experience planted a seed about pursuing research in my career, and reminded me that mentorship and early successes along the pipeline are so important. And there are points along the academic pipeline where it can suddenly become leaky. I would submit to you that women and those who are underrepresented in medicine, sometimes have different backgrounds and early opportunities, and may represent a set-up to face early discouragement, and not to continue down a path towards success. So, we need to start in high school or college, and continue with medical students, residents, fellows, and junior faculty. I’m going to share with you some reflections on medical students and early-stage faculty members, as I have had experience developing and leading programs that target this part of the pipeline.

Some of you on the webinar tonight were mentors for our APS-SPR Summer Student Research program, which had 23 years of sustained funding from the NICHD, as well as APS and SPR funded grants. Typically after their first year of medical school, the young

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scientists worked in a basic lab or clinical research group outside of their own institution. The funding opened the door for a new experience at a different medical school and hospital. The students typically worked 8–10 weeks over a summer, after which over half of them presented at the PAS Conference. Some of you remember that we were all cheerleaders on the front row, as 30 or more student participants were presenting, and we had a reception at which we gave each of them a plaque to highlight their participation. Their mentors were there, as well. It was an amazing and encouraging experience for these young people, with the hope that we could convince them to go into pediatrics and academic careers.

Moving down the pipeline, another challenge is experienced by the first-time faculty member trying to secure protected time. The MD or MD-PhD is pulled in many directions, limiting their time to engage in research. Earlier in my career at Boston Children's, I led a program supported by Harvard, MIT, Pfizer, and Merck. We selected 20 fellows from one of the 17 Harvard hospitals and provided a stipend to cover 75% of their effort, which was deemed as the appropriate amount of protected time to be able to think creatively, write grants, and build their research team. The goals were to enable the successful submission of a K award as a key step in advancing down the pipeline. A second program that I had a great experience with was serving as co-director of the Trustee Awardees/Proctor Scholar (TAPS) Program. I directed the Proctor Scholars Program, which was designed for MD or MD-PhD investigators at Cincinnati Children's Hospital. As with the program in Boston, the goal of this program was to protect the young clinician-scientist for 75% of their time to enable them to make accomplishments that put them in a good position to receive a K Award. With both programs, organized events enhanced networking with mentors, which led to opportunities for new collaborations, as well as career support. These events boosted morale among the research faculty, and in general could serve as a mechanism to prevent burnout in a department, especially during times when grant pay-lines are so low.

Important metrics of success for these programs included: tracking how many of the medical students went into pediatrics, as well as research; how many of the junior faculty obtained K awards followed by R01s; and successful publication records and presentations for program participants at all levels. These metrics enable us to pool data and draw conclusions as to whether there has been a return on the investment. It is important to track trends among the men, women, and those who are underrepresented in medicine, and to make sure that we have success in all of these groups, and also recognize barriers to success.

In closing, we should all be building pipelines within our divisions and departments, and assembling registries to identify and highlight who enjoys mentoring and is good at it. A strong mentor can become like "the Pied Piper." We all know "Pied Pipers" in our divisions and departments, as they take on mentees and it becomes a "win-win" situation. I also think about how this can align nicely with equity, diversity, inclusion efforts at a hospital and medical school. Such programs support the trainee, but importantly, further recognize the mentors. I'm just thinking together about what I said at the beginning: all of us looking for that young scientist, that young Catherine Gordon, who is at an impressionable point in his or her career.

(SD): Catherine, it's been said that the mentor-mentee relationship is really a two-way street. Could you further comment on that?

(CG): I alluded to it, Stephanie, with the win-win. I like to think of the mentee and mentor establishing a good relationship in which they both are learning from one another. I think that the key to these relationships is good communication, and expectations should be set from the start, by asking what will be accomplished both short-term and long-term, and who will be responsible for what. I encourage an agenda prior to each of the meetings with my mentees. We can then

better think and plan together, select some agenda items for each meeting, and then check off items after they are accomplished.

(SD): We are now going to turn it over to Dr. Hostetter.

Margaret (Peggy) Hostetter (PH): Thank you very much, Dr. Davis, Dr. Abman, and fellow panelists. I'm so pleased to be here. As the five of us strategized about the content of this seminar, we chose fellowship as a pivotal moment in the academic pipeline. Fellows are on the cusp of an academic career. The motors are revving. They're ready to take off, but it really behooves them, and those of us who may be mentoring fellows, to analyze the runway and not just glide into fellowship. The first critical decision for every fellow is, "What do you want for your career? Do you want a clinical emphasis? Or do you want a research emphasis?" These are certainly not mutually exclusive, particularly if you're interested, for example, in clinical/translational research. However, each choice has very special requirements.

For those fellows choosing a research emphasis, you really need to find a fellowship that will accommodate 75% research time in the research years of the fellowship, especially if you're an MD. Remember that MDs make great investigators, but they have to be ready to surmount some hurdles. The biggest one is that most MD fellows have a late start compared to their MD/PhD counterparts. There are ways to make up for that lost time through 75% protected time during the fellowship. There are institutional training grants called T32s, and they are designed to protect fellows' time for research. There may also be a T32 training grant, sponsored by the NIH, right in your very own division or in another division that is open to you.

Then there's the Pediatric Scientist Development Program (see <https://amspdc-psdp.org/>), which Dr. Abman mentioned. The PSDP is an NICHD-funded, national training grant for MDs or MD/PhD Fellows. Finally, subspecialty societies have training grants. All of these can help a fellow gain 75% protected time for research during the fellowship.

Next, let's talk about three very important steps toward success during the fellowship.

The first, of course, is choosing a mentor. Finding the right mentor can be a challenge, but it's also one of the great gifts of fellowship, whether you're looking for a clinical emphasis in your fellowship or a research emphasis. Be sure and look at the track record of the mentors whom you consider. What are their trainees doing? What do their trainees have to say?

For those fellows choosing a research emphasis, the mentor whose clinical acumen you most admire may not be the right mentor for the research component of your career, unless he or she really has a number of grants in that area. So, how can you find out about that? Well, you can ask your proposed mentor for their NIH biosketch, you can look up their grants on NIH Reporter, or you can review their publications in PubMed and see what they've written. All of this will help you scope out the situation and find the mentor that's right for you.

Now, the second key step to success is choosing a project, and that can be equally challenging, but also very rewarding. I do remember when I was talking to my research mentor at Boston Children's in the late 1970s about the research project I wanted to do. I was convinced that the third component of complement was the key to young children's defense against pneumococcal or *H. flu* infection. Remember, back then we didn't have polysaccharide vaccines. So, based on what I was reading in the literature, I was going to collect serum from little children, place pneumococci or *H. flu* in the serum, and measure complement activation, etc. I went on and on about all of this with my mentor who listened intently, and at the end of my presentation, he said "NO!" What he meant, of course, was that what I was proposing was very descriptive. Fellowship was my opportunity to rise to a challenge, to *get out of the playpen*. That's what my mentor did for me. He put me in the lab of a PhD protein biochemist. I was shocked. I'd never been in a lab before. It took me about 12 months to be able

to walk and talk in the lab at the same time. However, that's developmentally appropriate for research neophytes. In the end, it was a wonderful, career-defining experience. T32s, the PSDP, and many subspecialty grants offer you the opportunity to choose a mentor and a project that may be a little bit outside your traditional discipline.

The third step is to start your network. That typically begins in your third year of fellowship and carries through into your early years as a faculty member. So, if you're looking for a fellowship with a clinical emphasis, then ask your mentor, "How about the American Academy of Pediatrics? What are the linkages there for me? What about subspecialty society meetings for the clinical arm of my subspecialty?" Remember, of course, don't just attend the pediatric sessions, engage with the entire subspecialty meeting. The same is true if you're on the research side; begin by participating in a journal club, or start one. That's a great way to meet young investigators in other labs. Make sure that you always try to submit an abstract or a poster to your subspecialty's research meeting, and don't confine yourself just to the pediatric sessions.

There are certainly some pitfalls to guard against in fellowship. Choosing a mentor based on personal affinity may not be the right way to go. Not investigating opportunities that are open to you at your institution or another institution can limit your options. Let's say you're interested in understanding inflammatory cells in colitis, and nobody in your division is working on this. Well, there's a Department of Internal Medicine with a GI section, and there are basic science departments at your institution. So, *get out of the playpen*.

Remember the pitfall for not allowing yourself enough time to start a research career. This requires 75% protected time during the research years of your fellowship. How can you do that? Well, for example, in a 3-year fellowship, if 12 months of clinical time are required, ask if you can do 9 months of clinical time in year 1, 2 months of clinical time in year 2, and 1 month of clinical time in year 3. This gives you 75% protected research time in years 2 and 3 and still allows you to fulfill your clinical responsibilities.

Lastly, of course, don't let medical school debt deter you from fellowship. There are NIH educational loan repayment programs (<https://www.lrp.nih.gov/>) in many of the institutes, like NICHD, NIMH, and across the NIH. These programs will pay up to \$50,000 a year of educational loans plus applicable taxes for 2 years, and you have the opportunity to renew for 1 or 2 years. So, these are just some of the enhancements that help Fellows fly into independent careers.

(SD): Thank you Peggy. One question is "when is the best time to have a baby?"

(PH): Well, Stephanie, now that I'm in my 70s, I think I finally have it figured out. The best time to have a baby is 37 to 40 weeks after you become pregnant. That's the biologic answer and one that may not be completely under your control, but there are many other aspects that you can control. The first, of course, is just the realization that starting a family is absolutely compatible with starting a career, but be sure you investigate maternity and paternity leave. For example, the duration of maternity leave as a resident may not be the same for fellows. It may be completely different for faculty members as well. So, don't wait until they're telling you the Apgar scores to find out about maternity and paternity leave.

The second important issue, of course, is childcare. Institutional childcare is a wonderful boon. I had that at the University of Minnesota. It was a tremendous benefit, but many institutional childcare centers have long, long waiting lists. So be sure to get on the list in plenty of time.

And thirdly, think of your fellow fellows, or if you're junior faculty, think of your colleagues. They're going to be covering for you when you're home on maternity or paternity leave. So, think a

little bit about trying to do some extra call upfront so that you're paying it forward for them.

(SD): We are now going to move to our third panelist, Dr. DeBaun.

Michael DeBaun (MD): Thank you for inviting me, Steve and Stephanie. Before I start, I wanted to chime in on a couple of comments that Peggy mentioned. I would suggest that junior faculty, residents, and even medical students develop an approach to finding a research mentor. I would like to provide several concrete recommendations for finding a mentor.

First, I highly recommend going to the NIH Reporter website (<https://reporter.nih.gov/>) or Grantome (<https://grantome.com>): search engines for funded NIH research. While in the search engine, you can type in the potential mentor or even the Department or institution and review the current and past NIH funding. If there is no NIH funding during the search, the absence of NIH funding doesn't mean that a faculty member is not appropriate to be your mentor. However, the absence does mean that the potential mentor's scientific momentum may not be as strong as someone with two active R01s or multiple previous R01s (an R01 is a National Institutes of Health investigator-initiated research award, with annual funding typically between \$250,000 and \$1,000,000 per year for 3 to 5 years).

Secondly, I would suggest going to *PubMed.gov*, and look at the publication record of your potential mentor. The number of publications and the order of authorship should help determine the scientific momentum of the potential mentor. Typically, the authors who are first or last have the most influence on the publication.

After you do your homework on the potential mentor, suppose you want to work with a junior investigator. In that case, you should seek co-mentorship with a senior investigator. In the end, when you submit your mentored-grant application for funding to a foundation, your local institution, or the National Institutes of Health (K12, K08, K99, or K23), the quality of the application will be heavily weighted toward the strength of the mentor's track record for funding and their prior mentees that have received NIH funding.

As Catherine and Peggy have mentioned, protected time means limited clinical service. Typically protected time translates into clinical service 6 to 8 weeks a year or clinic 1 day a week. There is some perception that you need a minimum amount of clinical time to be competent. There is probably some truth to this statement, but the duration of clinical time is assuredly person and subspecialty-dependent. Occasionally a physician-scientist, depending on the subspecialty, will have both inpatient and outpatient service. After you have finished your fellowship or your mentored award, what is next? The interval between leaving your mentor's laboratory and starting a new position is a crucial transition time.

The best time to start to transition toward your independent research laboratory is when you start as a fellow, and you engage in a dialog with your mentor. In these conversations, you want to know what project is portable? You must ask the question, "What project can I take from this laboratory and move with me when I establish my own laboratory?" Even though you're "knee high to a grasshopper" and not sure what you're going to end up doing, you should have a conversation with your mentor about the next steps and how to transition to an independent investigator. You can't afford to wait and discuss what project is portable during the last few months you spend with your mentor in their laboratory. To ensure that there is no ambiguity in supporting an independent career for mentees, in our letters of support for mentored awards (NIH or foundation-funded), I state that we have curated an investigation trajectory independent of my own.

After you've finished your fellowship or mentored research award, you will next consider a startup package, which is a unique challenge. Startup packages are often used as a bargaining chip

for a new position. The common perception is the larger the startup package, the greater your likelihood of success. However, I have yet to see data demonstrating the strength of this correlation. Other factors are essential for a successful transition from a mentored award to a successful career as a physician-scientist, including the scientific environment of research, quality of the scientific mentorship and sponsorship, access to the latest technology, and a critical mass of established physician-scientists dedicated to providing iterative feedback about the quality of your research.

I have yet to see any successful physician-scientist that works alone. Principal investigators are the leader of their own team, and collaborations across disciplines require the concepts of teamwork and leadership skills. One of the challenges that I have found when running my lab is how to develop leadership skills. Most of my mentees can recite the Krebs cycle, the most recent antibody therapy, but most can't tell you about the *Seven Habits of Effective People* by Steven Covey, *The 21 Irrefutable Laws of Leadership* by John Maxwell, or *The ONE Thing* by Gary Keller. Given the importance of leadership for mentees, we spend about 50% of our time during our laboratory meetings focusing on improving leadership skills by reviewing the classic books on leadership and self-improvement.

So, when you start your laboratory (basic or clinical), I recommend develop a laboratory culture of growth and leadership for yourself and mentees. Also, start mentoring early in your career with undergraduate students, medical students, residents, and fellows. Learning how to mentor is critical for reaching the next level of your academic career. I would recommend you start mentoring before you have your laboratory because if the first experience you have to mentor is when you have your lab, you're in for a rude awakening. Mentoring is an acquired skill and is a prerequisite to becoming a physician leader.

The additional strategy I would take in constructing a laboratory culture is choosing senior faculty to be part of your research team. I remember starting as a faculty, and I probably asked two dozen people how to run a laboratory because I had never been to a laboratory meeting as a fellow. So, I established my own set of rules based on listening to what was effective in other settings. Mid-career, I launched a great collaboration with a senior faculty, a gentleman named Bob Strunk, MD, Professor of Pediatrics, Washington University School of Medicine. Bob was an outstanding physician-scientist focused on elucidating risk factors and optimal therapy for pediatric asthma. We blended our knowledge of two different disciplines, lung disease and sickle cell disease, to design clinical and translational studies focused on advancing the health care of children and adults with sickle cell disease. I would highly recommend seeking out a colleague who is maybe 15 to 20 years older and with non-overlapping expertise.

There are times in your career when you should seek advice outside of your institution. On a personal level, when I was in mid-career, I reached out to George Buchanan, MD, Professor of Pediatrics, former division chair of Pediatric Oncology at the University of Texas Southwestern School of Medicine; an exceptional pediatric hematologist-oncologist with a wide breadth and depth of knowledge. I flew to Dallas, brought him my favorite bottle of wine, and sat down and had dinner together. I wanted to get an objective view of my career. I peppered him with a series of questions, such as the pros and cons of moving away from being a full-time physician-scientist to being a physician-administrator still conducting some science. The dinner provided an opportunity for me to calibrate my career trajectory from someone not in my ecosystem.

I next flew out to the East Coast and met with George Dover, MD, Professor of Pediatrics, and former Department Chair of Pediatrics, Johns Hopkins School of Medicine, and had almost the same conversation. George gave similar advice that resonated with my aspirations.

In summary, I recommend creating a culturing of mentoring, developing leadership skills, developing collaborations with senior investigators outside of your expertise, and seeking advice from those that have traveled the route previously but who are not at the same institution.

(SD): Thank you, Michael. Could you comment on the similarities and differences between clinician-educators and physician-scientists in regard to resources and mentoring needed to launch an academic career?

(MD): That's a loaded question because the reality is that with each passing decade, there's an increase in the attention to our relative value units (RVUs), a measure of patient care service activity, and less focus on advancing the research agenda for child health. Suppose the future of advancing child health science depends exclusively on physician-scientists who have R01s (investigator-initiated research funding from the NIH). In that case, the pace of discovery to advance child health will undoubtedly decline. We have to do a better job of finding the right balance to allow clinical educators opportunities to participate in the research enterprise. We can't afford to squander the precious human capital of physicians who have devoted their professional care to improving child health.

The future of pediatric research must involve clinical educators. There has to be a better strategy to reward clinical educators' participation in the research enterprise. For example, I was the principal investigator for an NIH-funded multicenter, randomized controlled trial. During the trial, we screened 1000 children with sickle cell disease with an MRI of the head for silent strokes at 29 clinical sites across North America and Europe; each site had a site investigator who did not get the credit of being the first or last author for our *New England Journal of Medicine* manuscript (https://www.nejm.org/doi/10.1056/NEJMoa1401731?url_ver=Z39.88-2003&rft_id=ori:rid:crossref.org&rft_dat=cr_pub%20%2000www.ncbi.nlm.nih.gov).

Despite the lack of academic credit, each site investigators spent precious time enrolling participants, supervise the local research team, overseeing the local research governance, and attending the annual trial meetings, when they could have been seeing more patients and increase their RVUs. The completion of this trial could not have been done without the unselfish dedication of the clinical educator. Unfortunately, the faculty incentive to participate in these large NIH multicenter studies is decreasing.

(SD): Thank you, Michael. For those of us who have been aiming for a basic science academic career, it feels like there's a lot of support and cheerleading during the MD-PhD phase, encouraging us that we can do this and be successful. Now, after finishing clinical training and trying to establish my scientific career as a postdoc, it feels like so much of the true support has disappeared. There are theoretical supports if you've already earned a K, but how do you receive protected time to build the necessary preliminary data, publish, and earn the K? The two programs that Catherine mentioned sounded great, but are there national programs?

(CG): There are local funding programs for young scientists at large children's hospitals, such as Boston Children's and Cincinnati Children's, as I spoke about earlier. I have also worked at a smaller hospital, and it can be important to identify mentors through NIH Reporter. Many potential research mentors may have philanthropic support, or small grants from professional organizations that have spin-off funding for trainees, medical students, or postdocs. Establishing a local network of scientists is important, so even if a given mentor does not have funding in hand, one of their colleagues may, including slots on training grants.

(PH): From the Chair's perspective, this is all part of faculty recruitment. Whether you're already at the institution as a Fellow, or whether you've been recruited from the outside, a Chair who understands how research works is going to be adamant that you must have 75% protected time. The department or the division is

then obligated to set aside the money needed to assure this protected time. Now, there are some additional programs that Catherine mentioned that can be helpful. One I really want to talk about is the Child Health Research Career Development Awards (NIH-funded institutional K12 awards—see <https://www.nichd.nih.gov/research/supported/chrcda>). Currently, 12 Departments of Pediatrics across the United States have these awards in place: the award supports protected research time for three to four junior faculty investigators a year at each institution. Obviously, as Catherine and Michael mentioned, transitioning to independent funding is very important. The institution won't maintain that K12 funding from NICHD if their young investigators don't translate into R01-funded physician-scientists. So, it's a two-way street. The institution gives you the money to protect your time for research, and then you are expected to garner research funding in return.

(SD): Peggy could you comment on the difference between a sponsor, coach, and mentor?

(PH): Here's a quick summary that I think is very clever. I found it on the internet, so I can't take any credit for it. The definitions are: A coach talks **TO** you, a mentor talks **WITH** you, and a sponsor talks **ABOUT** you. A sponsor is something we don't talk a lot about in academic medicine; it's much more common in the business world. Your sponsor is the person who puts you forward at the expense of his or her own reputation. The sponsor says, "Look, this person is really good, she needs to move to this higher level, she's absolutely capable of doing the job." If you're a success, the sponsor's reputation is burnished, too. But if you don't do the job, the person who loses most is the sponsor who put you forward. So, the coach talks **TO** you, the mentor talks **WITH** you, and the sponsor talks **ABOUT** you.

(SD): Thank you. How can we best utilize senior faculty for mentoring, sponsorship, and how can we best utilize their talent and experience?

(MD): Well, that's a loaded question, being 61 in 2 months, thinking about what will I do for the next, I don't know, years? The key point is successful academic scientists may have extensive clinical experience and wisdom which cannot be easily replaced when they leave the institution. Questions such as: "How did you choose when you were going to step up to a national leadership position for election?" Senior faculty can provide answers to these questions and many more.

(SD): For those of us who are junior faculty who are hired for a predominantly clinical position, but with academic productivity expectations for promotion, what advice do you have on balancing clinical responsibilities and academic expectations?

(CG): I think that's a really great question and what represents the plight of many faculty is that academic promotions and reappointments seem too often be based on the number of publications and successful grants and contracts. Over time, I have certainly expanded my definition of scholarship. So, all publications do not need to stem from a double-blind randomized controlled trial. There can be unique case reports and case series that teach important lessons and that stimulate the research of others, and inform clinical care. I've done a lot of work with children with Progeria, and I think, some of our small case series have helped improve the care of these children with an ultra-rare disease. I think the other really positive experience I've had is collaborating with clinician-educators. As a clinical investigator, those clinicians who are in the subspecialty clinic will refer patients, and I have been able to enlist their help as a co-investigator. They provide really important insights as we are writing abstracts and papers, and ultimately, our collaboration provides the much-needed publications that they can put on their CV, for reappointments or promotions.

The last comment I will make is that there are a lot of opportunities within academic centers. And I have gotten feedback from my faculty that buying them out of one or two clinics can exponentially enhance their productivity academically.

Short-term these investments for select promising faculty can pay off in the long run.

(MD) With the electronic health record documenting the number of patients seen per hour per day, we will continue to see a tension between increasing the patient service mission and pursuing the academic mission.

(PH): I would add that I think there's some real creativity in the clinician-educator who highlights new associations. For example, back at the University of Minnesota in the mid-1980s, a neonatologist, Dana Johnson, came to me and said, "You know, Minnesota is the national leader in children adopted from abroad, and yet there are no national guidelines on how to evaluate these orphans." As an infectious disease doctor, I'd never heard about this phenomenon, and yet, soon we had our neonatologist, our occupational therapist, our nurse practitioner, and our ID doctor bringing their clinical expertise to start a new program. So, I think encouraging the creativity of the clinician-educator to pull things together in new ways and develop multi-disciplinary programs can be really great for enhancing a CV.

(SD): Great advice. How do you get recognized as a key contributor to a team, if you're often the middle author? Yet, you are absolutely essential for the team's success.

(PH): It's not unusual to encounter a situation where someone is clearly ready to be promoted, but they're always a middle author. They may be the person who does the flow cytometry, the proteomic analysis, or the statistics. For the promotion letter, it is essential that the senior investigator give full credit to that team member and emphasize that this work and all of the senior investigator's other publications and major grants could not have gone forward without the special expertise of that member of the team. If the internal letters from the senior investigator(s) attest to the importance of that particular person to the success of the research, and if the outside letters say this is an incredibly inventive expert whom I'd love to have in my lab, then you will be promoted for your role in team science.

(MD): Rarely is there one manuscript in these multicenter projects. The leaders of these large projects have a responsibility to promote the inclusion of the site investigators and early stage investigators for first-author manuscripts, ancillary studies, and presentations at national meetings. For example, we leveraged the scientific momentum of the large sickle cell disease trial, I previously mentioned, to support three NIH mentored awards (K23) at different institutions.

(SD): Thank you, Michael. You're absolutely right about these multicenter studies. It's so important to outline at the very beginning how all that's going to work. Could you talk a bit about the New Century Scholar, and RAPID programs as key resources for underrepresented minority trainees who are looking for mentors?

(MD): The New Century Resident Mentoring Program is a program supported in part by the American Pediatric Society, American Board of Pediatrics, and Ambulatory Pediatrics Association. The mentorship program is aimed at increasing the diversity of the pediatric academic workforce (New Century Scholars Resident Mentoring Program|Academic Pediatric Association (academicpeds.org)).

The Research in Academic Pediatrics Initiative on Diversity (RAPID) program specifically focuses on young scholars (residents, fellows, and junior faculty) who identify as underrepresented in medicine disabled, or from a socially, culturally, economically, or educationally disadvantaged background, and who are committed to a career in academic general pediatrics (RAPID|Academic Pediatric Association (academicpeds.org)). The applicants must obtain a letter of support from their Department Chair and their mentor. Glenn Flores, Chair Professor of Pediatrics, University of Miami Health System, Miller School of Medicine, has done an outstanding job. He recently published an article describing some

of the challenges associated with underrepresented minorities in academic medicine.¹

(SD): Catherine did you want to say something?

(CG) Michael, that was beautifully summarized, and I think what these national programs have done, and their spinoffs at some of the larger children's hospitals, is exciting. I know Boston Children's is thinking about initiatives to expand opportunities. I think that's a really key point, it's making sure that everyone has the same opportunities, and that we also are there as mentors for our junior faculty, and that we're tracking them, and encouraging their success.

(SD): Thank you very much for going through those programs. Could you comment on how to develop resiliency through all of this?

(CG) Right. That's a philosophical question here, Stephanie. I think we're all in it together, and thinking about the pipeline tonight for medical students and faculty, but it has to start back in high school and during the undergraduate years, or even earlier. We all have colleagues who tried several times to get into medical school, and finally got in. And all of us know that we put in as many or more grant applications than have those that fund. And, I think that one thing that I tried to do and my mentors did for me was to show me the number of applications and papers that were submitted and that were rejected.

I always say to my mentees, OK, we're going to give ourselves one day to be disappointed about this. But tomorrow, we're going to get right back in there and see what the grant reviewers said and try to view it as a game. That you can't always win the game of Monopoly when you play. And in the same way, you're not always going to get the grant, and it's not in any way a personal attack on you as a scientist. Mentees need to hear this from us as mentors. And sometimes, the higher risk ideas scientifically are the ones that the study section may not "buy" as they are high risk and high gain. So, we have to figure out how to package it differently, so that reviewers will open their eyes and maybe the message will be clearer and the application will fund the next time. I think this is a lifelong challenge.

(PH): I agree. I think it's really important to review one's own rejections with a junior faculty person or a trainee who may be stumbling over that first rejection. I worry that young academicians believe that their Chair or Division Director has never had a rejection, or has never made a mistake. It's very enlightening to be frank with them. I often start some of my career development seminars by talking about the first job I applied for after I left Boston Children's. I was told no, in resounding terms. I didn't get that job. Instead, I was hired in the Department of Internal Medicine, not Pediatrics, but that offered me an entire set of new colleagues with new approaches. So, after rejection, try to look for other opportunities. If you're stymied the first time someone says NO, it's going to be tough to move forward. You've got to build a little bit of a shield. I'm delighted to see that more and more girls and young women are entering sports because athletics is great training for life after sports are over. You know, you win some and you lose some, and you can't stop going out on the field just because you lost the last one.

(MD): Yes, so how do you build resilience? I do believe that faith is an important component of my resilience. My family is another component of my resilience. My wife and I dated in high school, and she has been my partner on this academic mission since my junior year in college. My immediate family and extended family have been a renewable source of resilience for me.

My commitment to the craft of being a physician-scientist while serving my community is a key component of my resilience. I have a special motivation to deliver and advance care for those from my community. As a pediatric resident, I realized the huge gap in medical care for children and young adults with sickle cell disease. I believed I could make a difference and no task seemed impossible.

At the beginning of the session, Steve gave laudatory comments about my professional awards and accomplishments. I wish he could have read off all the NIH grants that I submitted that were rejected. I rarely give up on a research idea, despite the mounting number of grant rejections. I just keep refining the concept and improving the strength of the preliminary data needed to obtain the grant. I do not like rejection, but I learned how to turn the grant rejection into a dress rehearsal for the following grant. I accept rejection with the peer review as part of the process of pursuing excellence, improving my writing, and conducting rigorous science.

(SD): Thank you. Here's a little bit more of a practical question, is it better to have more papers in a journal with lower impact factors, or fewer in higher impact publications?

(PH): I think most people would say it's better to have fewer as first or senior authors in higher impact journals, but that doesn't mean that you should always forego sending a paper to a journal with an impact factor of 2 or 3. Fewer papers in higher impact journals indicate that you can be a heavy hitter when you need to be. When I review CVs for promotion, I like to see some balance. Clearly, there is outstanding work that should be in the *New England Journal of Medicine*, *Science*, *Nature*, or the *JCI*. However, we're all pediatricians, and if the manuscript's message is purely pediatric, under those circumstances it's going to be very important to publish in a pediatric journal, which may not have as high an impact factor.

On the other hand, I have seen trainees in a lab that said, you know, we only publish in *Science* and *Nature*, and so you're going to be here for 7 years without a paper until it's ready for *Science* or *Nature*. And that's a real problem. And that person, of course, is being held hostage to a journal and after 7 years with no papers, or maybe one on the way, that's very problematic.

(CG): Peggy, that was going to be my point. One can launch a substudy from a larger parent study that may go to a clinical journal, while results from the original parent study are published in a high-impact journal. I ask my mentees to think about to whom they want their message to be geared. I've skated between adolescent medicine and endocrinology my whole career, and sometimes I really want to get a manuscript accepted by a clinical endocrine journal because I want the endocrinologist to think with me about something I'm doing, and at other times, to a broader audience, a journal geared towards general pediatricians or adolescent specialists. And I think that this strategy has enabled me to gain some new collaborations. It's really been effective, in terms of team science.

(MD) I think all of us would agree that the absence of any publication over a prolonged period does not bode well for the mentee's academic trajectory or the training program's performance in supporting physician-scientists.

(CG): Stephanie, I have one other thought. As a clinical investigator, one type of publication that's been helpful for me and I think helpful for my promotion along the way was to be involved on clinical guideline committees. These were consensus committees on a national level, and there have been opportunities sometimes to write, similar to a white paper, on a topic that's giving guidance to all pediatricians on some aspect of pediatric bone health or vitamin D deficiency. This has been another kind of scholarship, aside from the traditional peer-reviewed articles, that has been helpful for networking.

(SD): Thank you. One of our participants mentioned, there is something called a CV of Failure, this dovetails back to what we were talking about earlier, which details your rejections. This is worth keeping to show the enormity of work that you produce and how your career has progressed.

Now, another question from one of our participants. Any opportunities for Deferred Action for Childhood Arrivals (DACA) minorities who may be interested in health care that you can suggest?

(MD): I don't know about opportunities for DACA trainees in medicine. I will say that institutional rules for employment are carefully scrutinized. There are funding opportunities for people who are not US citizens. You have to do your homework to identify the right place to ask that question.

(SD): Final question. What is the major cause of physician-scientists to drop their research program? What do you think leads to that?

(MD): I don't know. I haven't experienced dropping my research program. I can tell you the two major threats that may have forced me to stop my research and go into private practice, lack of time with my family and personal finances. As a father of two and a husband, I attempted to integrate work and family life. Most vacations were working vacations where I would write a grant or manuscript when the children were asleep or engaged in other activities. The upside of this approach is that our children saw me pursue excellence with a singular focus, and the teamwork between my wife and me to achieve our joint family goals. Our children saw both of their parents live the motto of "hard work pays off." Fortunately, we were able to live below our means, provide optimal educational opportunities for our children, and have fun experiences as a family. The children realized the power of hard work and family teamwork to accomplish our goals. So what turned out to be a significant threat to my research career, the lack of time, and a modest living style, resulted in an asset for establishing our family culture.

(PH): Let's discuss what we know about women in medicine and women in science. From the standpoint of women in academic medicine, we know that there is a major point of departure when women reach the associate professor level. The same seems to be true for women in research. Given this, it's clearly not only childbirth that leads to this departure. It's all the issues that Michael highlighted. Losing funding for your research may be problematic. There are very good data demonstrating that women's startup packages are significantly less than males' at equal rank, so if you don't receive that grant renewal, your startup package may well be gone. The same is true for faculty salaries; gender-based inequities are not uncommon. So, monetary issues from lack of funding, salary disparities, and family considerations with growing children are all reasons for anyone, but women in particular, to leave the world of the physician-scientist.

(CG): It's hard to top those really important comments and again when I started this afternoon's session describing the leaky

pipeline, it underscores what Peggy just said. I have seen many women and underrepresented minorities who get discouraged and especially those promising scientists who are transitioning from their K award to their first R award, and the first R to the second R is even a smaller group. One observation that I've made and have always strived for is remembering that work-family or the work-life balance is not always achieved by making them separate buckets. Like Michael, I try to live by the "hard work pays off" motto and have also tried to instill that motto in my children.

I have also tried to include my children whenever I could when I had medical or professional meetings in an interesting place, and especially those meetings where I didn't have to attend every session. I would give a talk or go to a couple of meetings, but if the meeting happened to be at Disney World, I would try to take my kids with me. I have a wonderful husband who has always been supportive of my career and would take our kids to see Mickey Mouse when I was at the meeting and then I could join them later. And in all seriousness, my kids saw me working and saw the benefits of that. Mom often had to go to the office or hospital, but they got to go on these trips with me sometimes, and I think as they have gotten older, they were proud of that and again saw the hard work paying off. So, it's all about making choices, but I would say sometimes it's not as black and white as it may seem to be. Blending my professional and personal life, whenever I can, has been a good strategy.

ADDITIONAL INFORMATION

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REFERENCE

1. Flores, G. et al. Keys to academic success for under-represented minority young investigators: recommendations from the Research in Academic Pediatrics Initiative on Diversity (RAPID) National Advisory Committee. *Int. J. Equity Health* **18**, 18 (2019).