THE BIOMEDICAL TALENT PIPELINE: TRAINING THE NEXT GENERATION OF SCIENTISTS

Celine Gounder 00:20

Physician-scientists make up about 1.5 percent of American doctors in NIH's last full count in 2014. This year, NIH made about 11 percent fewer awards than its five-year average. And in Britain, clinical academics under 36 fell by a quarter in a single year. Monica Bertagnolli led the National Cancer Institute and then later the NIH, and she's now president of the National Academy of Medicine. I'm a member myself, so she's technically my president. Lucy Chappell is the chief scientific adviser to the UK Health Department and runs the National Institute for Health and Care Research. And she still practices obstetrics in London. And finally, Sharmila Makhija is the founding dean of the Alice L. Walton School of Medicine in Bentonville, Arkansas. Her first class started in July of 2025, tuition-free. She's also a practicing gynecologist oncologist. And I'm Dr. Celine Gounder. I'm a medical correspondent with CBS News and also editor-at-large for KFF Health News. My big question overall is going to be: Who gets to stay in science? Who gets to enter the sciences and who gets to stay in science? Monica, you've argued that every clinician should be asking what they need to know and feeding those questions into research. What's one discovery that came from that kind of lived experience?

Monica Bertagnolli 01:58

Oh, goodness. Well, you know, I'll give you one from my own career. There was a surgeon in the 1980s who was taking care of patients with the genetic disease familial adenomatous polyposis. And part of that genetic disease is to have a very large tumor called a desmoid tumor, which when you look at it under the microscope, it looks like an inflammatory reaction. And in fact, they used to be called myo[x]inflammatory or fibroinflammatory tumors. And so, he gave his patient, who had one of these big things, an anti-inflammatory drug. Why not? You know, it was used widely for arthritis or anything else. And all the polyps in their colon went away. And that was the first clinical observation showing something that eventually my lab took and ran with for many years, which was how blocking prostaglandins could prevent colorectal tumors. And I think it was this—I don't know how to treat this. There's something I have that's in my hands. I've looked under the microscope at this thing. I've come up with a scholarly hypothesis and

something that's not going to hurt. And it led to an amazing discovery. And I think things like this happen a lot. It's the curiosity—

Celine Gounder 03:24

Yes.

Monica Bertagnolli 03:25

—the willingness to think about the biology and come up with a real hypothesis, and he made an amazing contribution.

Celine Gounder 03:33

Lucy, Britain's under 36 clinical academics fell from, as I understand, 140 to 105 full-time posts in one year. What is driving that drop?

Lucy Chappell 03:45

So, I think we need to take a step back and look at clinical academic careers in the round. And when we talk about clinical academics, we're often talking about one category. And that's those academics who are employed by a university who also practice clinically. And we know the, particularly in the UK, the intense pressure that our universities are under. So, I'm interested in us thinking about clinical academics, particularly a more inclusive definition that recognizes the critical work that clinicians do with protected research sessions. And actually, in my time of training, from when we had a very sort of binary option of you were either university employed or you weren't doing proper research, we're now seeing a much more hybrid, blended career pathways, which really speaks to what our residents and our trainees are looking for. So, I'm very supportive of that. So, I recognize the real challenge that is with the data provided by the Medical Schools Council in the UK, because the numerator has reduced because of the pressure on the universities, and the denominator has increased because we're increasing our workforce. And in fact, we're describing how we are also increasing the number of academic posts. So, at the NIHR, we're doing a couple of quite targeted interventions. And one of the really critical things is to look at the whole pyramid. It's not enough to drop in sort of selective interventions here or there. You've got to say, what does the doctoral, post-doctoral, and beyond look like in the pathway to independence? So, we funded clinical future leader fellowships, what we call our clinical FLF program, which has got a tapered, so, to begin with, the funder funds all of it, and by the end, the institution has taken over. And we fund NIHR research professorships, which really sort of rewards the best. And so, I think we are looking—we work very closely with UKRI and the Medical Research Council, and it's trying to make sure we look at all the challenges, and not just address a single kink in the pipeline, but see it across the whole patch.

Celine Gounder 06:04

Sharmila, you have a 48-student class?

Sharmila Makhija 06:06

Yes.

Celine Gounder 06:07

And no MD PhDs.

Sharmila Makhija 06:09

Right.

Celine Gounder 06:09

Where does research fit for a student at your medical school who may want it?

Sharmila Makhija 06:14

Yes. So, our curriculum is called ARCHES, so the R is for research. And most medical schools do not consider that a mandatory teaching opportunity. We did make it mandatory. And probably I'm a little biased because I did have such a wonderful experience in research, and I was a translational researcher. I was a WRHR Scholar, and I think that exposure really helped me to understand how to take care of women with cancer, how to answer the questions, and I felt very strongly that our students needed to, at least at a minimum, be exposed to the opportunity. And so, even our research is really focused on the fundamentals and the basic concepts, but their projects have to be either with someone in the community or with our partners at Stanford. And I think that opportunity gives them the exposure to population health. Doesn't have to be—not that we don't feel value for what I had—that same training of working with very structured roles in the academic setting, but we have our partners at the University of Arkansas that help support teaching our students. I wanted them to see that there's more to research than just in the academic environment per se, and then open their minds to that. And I think that what we have found, even with our first two years, is there's been a demand from the students to have even more opportunities. So, I felt like at least having that exposure, especially in light of the current training issues that we see across the country.

Celine Gounder 07:56

Now, you recruit students from rural backgrounds.

Sharmila Makhija 07:59

That's right.

Celine Gounder 07:59

And you charge them no tuition.

Sharmila Makhija 08:01

That's right.

Celine Gounder 08:02

You haven't asked them for a service commitment, at least not yet.

Sharmila Makhija 08:04

That's right.

Celine Gounder 08:05

Will you, and would research count towards such a commitment?

Sharmila Makhija 08:08

Yes. So, through the generosity of Alice Walton, free tuition for the first five cohorts. We did not have an expectation just yet. We did understand that we wanted to have those students from a rural background, those from a lower socioeconomic status, those that having free tuition would make an impact on their lives and reduce the burden of debt that they would have. We are now building out a health-care campus, that we will have inpatient and outpatient settings, a three-million-square-foot facility, and that we will likely start to move towards an expectation. But we didn't feel it was fair to do that until we had something ready for them to go to.

Celine Gounder 08:51

Now, Monica, you've said that, and we know MD PhDs earn less over a career than MD colleagues in the same specialty. And you've also said we lose people before they even choose this path. What gets them over that hump?

Monica Bertagnolli 09:06

I think it's sheer determination in many ways.

[Laughter]

Monica Bertagnolli 09:10

What a path. No, I think, if you're going to pursue a PhD together with an MD role, you have to be truly committed toward both sides of the equation. You have to be in love with your science. And just to be sure, science can be anything. A PhD could be in behavioral research. I'm not implying it's that there's one particular type of science. I think the general principles apply to all of it. You have to be in love with your science and also be in love with being in the clinic and understanding the needs of people. Where a person ends up with their ultimate career on that balance is just distinct to individuals. I mean, myself, I was a clinician my entire time in active practice, but I was also a researcher the entire time. So, some people really do balance both, and others will focus on one or the other. But the unique ability to do both is something I think the individual loves and is committed to. Otherwise, you wouldn't go through the time, the effort, the commitment, and in many cases, both financial and personal burden it takes to get through that gauntlet.

Celine Gounder 10:38

We have some programs like loan forgiveness, with service commitment at the end—

Monica Bertagnolli 10:43

Yep.

Celine Gounder 10:44

—to help facilitate some of this. But what are some of the other things that can be done? Say you have a first-generation student who's sending money back home. How can we help facilitate keeping those kinds of students in science?

Monica Bertagnolli 10:57

Yeah. This is one of the biggest challenges we have right now because the way we have in the past been funding and supporting our students is some through philanthropy, some largely through the universities, but then also through the research programs that their mentors are able to acquire. So, there's been a lot of mentorship, and mentorships receiving NIH grants and other big funding are then able to bring on the post-bac graduates, the post-docs, bring them into the lab and further their education. This has been the huge crisis we've hit over the last almost two years now, is that every time a major researcher loses their big R01 grant, we lose that path for, from one, two, sometimes three young people who are dependent on that for their path forward. And I just want to add one more thing. One thing we have not done that I believe we absolutely need to do is let's bring the education to where the research is done. So much innovation and research in this nation is done in private industry. And I think we're all asking ourselves the question, since we're looking at the federal government doing less, what's the role of industry in this kind of work? And can we think of an industry environment as like that academic professor's lab? And the reason I know this approach works is it works in engineering. The engineers do this very well. It's not at all unlikely that a young person who's got potential would end up doing an internship, or whatever they call them, in an industrial lab, and I think that's one avenue we have to pursue for medicine.

Celine Gounder 12:52

Mm-hmm. I want to come back to that in a little bit.

Monica Bertagnolli 12:54

Okay.

Celine Gounder 12:56

Lucy, you—

Lucy Chappell 12:56

Can I just add something as well?

Celine Gounder 12:57

Oh, yeah. Go ahead.

Lucy Chappell 12:58

I think it's really interesting because conventionally, we've understood our career clinical academic pathways to be fellowships. And actually, we are taking a more inclusive view to recognize that there can be incredible opportunities for career development, very much as Monica said, both in our infrastructure, which is an equivalent of an intramural, but also our programs. So, growing people within our projects and understanding how that can support their pathways. So, it's not a sort of a first class and a second class option. It's that people will need to move between different career development. And I completely support Monica's view on how we might work with industry, and that includes pharma or medtech. It includes working with philanthropy in a different way—

Celine Gounder 13:45

Right.

Lucy Chappell 13:46

—to see those opportunities. And rather than a sort of you go in at one level and you come out 40 years later, to just see those zigzag. All of us are sitting here today because of the zigzags of our career, and I think that's true. We actually fund a research delivery workforce through NIHR. And we have nurses, midwives, doctors who come in to do research delivery and then get the bug, and that's fantastic. And so for example, we're growing our commercial clinical trial offer in the UK, and people get curious for all the reasons Monica said, which is, "How can I address what I see in front of me in the clinic?" So, they become an associate investigator, and then they stay. And I think that speaks to a more varied option rather than a sort of a single track to say there are many routes to career satisfaction, and it's up to us as funders and leaders to think about what those look like.

Celine Gounder 14:47

And the UK pays doctors on a national scale.

Lucy Chappell 14:51

Yes.

Celine Gounder 14:51

The US does not do this. Is protected research time Britain's answer to that pay gap and is that enough?

Lucy Chappell 14:59

Yeah. So, we're certainly looking at how to—I think it speaks to a point earlier about how do we properly embed research as part of health care. Because our vision should be that research and innovation, training, and education are woven through. So, there's both the opportunity to have sort of dedicated sessions, but actually, I practice as an obstetrician in a clinic that I think every contact should count. And, I think, that if we really want to democratize access to research across primary care, community care, not just in that very specialized secondary care we've got to think about where we have research leaders who do get that protected research time, but how to better recognize those who are research active, who are sort of, in any clinical setting can see the opportunities. And health data is a way we can help that. And, then, where we also just have a better acceptance and leaning into the idea of research across all our health and care. If

we want our health and care system to stay static and not evolve and iterate, we'll just say research is separate. If we actually want to improve our health outcomes and drive both health and growth, then we will have research embedded. And I think there needs to be a sort of, not a one-size-fits-all model for protected research time, but recognizing that if you need to go to a wet lab and do experiments, that might be the case, but to have a better patient pull and a workforce offer for research embedded across care.

Monica Bertagnolli 16:33

Mm-hmm.

Celine Gounder 16:35

Now, Sharmila, you are working with drug companies on how to pay for research training at your school. What is that relationship? What is the give and take in that?

Sharmila Makhija 16:44

So, we've just initiated those discussions because we really want to change how—as you brought up, Monica—that how do we work with industries? How do we work with all partners to look at producing the next generation of not only clinicians, but clinical researchers, clinical scientists? And they really have—these drug companies have really recruited many of the top scientists to help them with drug discovery and things like that. But we're bringing to them, looking at where our communities are, and especially in being in the heartland of America where you contain a lot of the rural communities. You know, we're bringing that back to the forefront of their thinking. And, as I mentioned, population health. How do we look at bringing the drugs and the work to the communities that need them? So, the campus that we're building out is really looking at this innovation hub of not only clinician scientists, but looking at with med tech, with developing better tools, but involving our communities and having them expose and seeing what are the impact that they can have on communities. And that's why one of the reasons that we also decided to really recruit students from a rural background because they're more likely to understand the needs of their own community because they're from there. If you look nationally, less than 5 percent of all medical students come from a rural background. Our first class was 15 percent; our second class is 25 percent. We're in the middle of recruiting our third class, and we do feel that doing that and also coming from first generation, we have about 40 percent that are first-generation college students. That opportunity, being able to give back to the community, is going to be really impactful. And many of these companies understand that, realize that, and they also see the changes that are happening in the country. And if they don't do something different, they're not going to be able to recruit those scientists to work for them as well. So, it's been a very interesting and easy conversation right now to have with them.

Celine Gounder 18:58

Now, this is a question for all three of you. And it's really an example of one of these kinds of instances where industry might become more involved. In September, Anthropic confirmed that it runs a wet lab in the Bay Area. Should AI, as well as drug companies and others, be endowing training slots at universities? And if so, who would set the research agenda? Maybe starting with you, Monica.

Monica Bertagnolli 19:24

[Laughter] Well, wow, what a great question. The foundation labs and the major impact they have, oversized impact they have right now on finances, frankly. That's where the money is today in a very big way, and where there is such tremendous need for people who really understand how to use those tools or are going to be at the forefront of applying those tools in ways that really help people. And I can't think how they could possibly do that without supporting that work to be done by the clinician innovator. So, yes, I think that there should be a part of that, and I think there also needs to be a single-minded focus, though, on benefit to the patient and to society, not to the funding bottom line of either a health system or a company. And so, usually that is done in, just as you described, in funding these kinds of projects and giving the freedom for the researchers conducting them to pursue what works best for patients.

Celine Gounder 20:42

Lucy.

Lucy Chappell 20:43

Thank you. Well, I think the opportunity and the challenge of AI and biosecurity is present for many of us. And I think sometimes the therapeutic index is quite narrow. So, the same things that drive therapeutic benefit can also be seen to be a threat. And I think that we should come together as a science community to consider that. So, it's inevitable that we should be doing this in partnership with industry. But I'm also quite keen that we don't just hoover the best scientists out of, for example, our government agencies who are working on this, so that we lose the very expertise that we need to grow.

Sharmila Makhija 21:24

Yeah.

Lucy Chappell 21:24

And so, I think those well-considered partnerships. We've also got the interesting opportunity of dry lab meets wet lab. And again, it should be seen as a virtuous circle, preferably, whereby we consider how AI drives therapeutic benefit but also addresses emerging threats. So, the government—the UK government has recently invested in this area. And I think that if we do it intelligently, there will be many spillover benefits rather than ending up with all the expertise, but not where it's needed. So, I really see—we're certainly in the UK government, working with the frontier labs to see how that's done. And to think about the—it speaks to the need for more diverse career pathways. You can name AI and biosecurity, where we're expecting data science to intersect with biology. We've generally trained people in a sort of single disease, single drug model. I think we are all recognizing that there are many other examples where we need to be able to encourage career pathways that look at the intersection of two areas. You might name even as simple as multiple long-term conditions, but physical health and mental health, work and health, so many areas where we've got to get out of a single silo and, say, lift up our eyes and look at wider intersections.

Celine Gounder 22:59

And Sharmila.

Sharmila Makhija 23:01

So, I think it's really important, I'm always going to frame it back to how we're training our students. And having run departments where it's very difficult sometimes to convince clinicians to change—

Lucy Chappell 23:13

Yes.

Sharmila Makhija 23:13

—or to utilize the newest technologies. We're really fundamentally teaching them how to embrace it, how to understand it, how to be critical about it, and be a part of the decision-making with the use of AI. And so, we have a health system science track that we have in the curriculum where we have a lot of flexibility to teach about current technologies. If you know about med schools, we have committees that decide what can be in the curriculum, what can't be, and that's part of the problem is it gets stagnated pretty quickly. So, we're really embracing that piece, teaching the students. We're partnering. Recently, we've just announced a relationship with Google to look at how do we use AI in the learning intelligence platform that we're creating now on how to educate them better. So, we want them to be a part of that solution to look at how it's going to evolve for the future. So, now we call it AI, but it's technology, and it'll be called something else a little bit later on. But how do we really use it to the benefit of improving patient care, their education. And I think that one of the areas that we really want to focus on is, as much as we talk about technology, front and center in our curriculum is bringing the human back. And I heard during the panel at lunch, we're sitting on the campus of a world-class museum. We feel like that trust has been broken with our patients. How do we build up that trust? How do we connect back to patients as a human being? And so, the art of healing is a big part of that track. And I was also pleased to see that the Anthropic CEO talked about that being very important in light of technology. So, we want to balance it. We want them to be empowered with knowledge and understand that it is here. How do we use it for the best for themselves as well as for patients?

Celine Gounder 25:14

Most of the pre-doctoral fellowships NIH terminated in 2025 and hadn't restored our diversity awards. And we spoke at the beginning of this conversation about lived experience and how that informs the questions you ask, whether you're a woman or somebody from an underrepresented minority or somebody from a rural area. Can—whether it's the US or the UK, can you build a more diverse research workforce when that's the very training that is being cut right now? Maybe starting with you, Monica.

Monica Bertagnolli 25:50

Yeah. So, one of the things we know, again, if we're lightning-focused on health and people's health, all health is local. And we know this. We know that the environment we live in, both physical and social, has profound influences on our health. So, this is the one of the things that, frankly, I'm the most passionate about, is we cannot have our innovators only live on the two coasts. We need our innovators to be in every corner because the solutions that are needed for health need to be responsive to local needs. Now, yes, maybe if we're talking about gene surgery. We talk about genetic surgery now, swapping out bad genes for good genes, that kind of thing. Yes, that might be focused at a center of excellence, but there is so much about innovation that also needs to come from a local wellspring. So, for me, diversity, it just means this is what we need to get people the health they need. And we can talk about men or women or

any way you want to slice diversity. To me, it means who are the people out there we need to serve and who are the communities? And that's what we need to pay attention to.

Celine Gounder 27:16

Lucy.

Lucy Chappell 27:17

So, I'd agree, and I'd actually frame it in terms of representativeness, because if you want your treatments and your tech to work and to change health outcomes, then you're going to ensure that your research is inclusive of a representative population. So, it makes scientific sense. I think back to my career when some of the biggest insights have come from ensuring that the population of trial participants are representative. I work in pregnancy hypertension, and looking at the outliers, looking at the differences and saying, "Okay, that drug didn't work, so where do I go back to the biology?" So, scientifically, that heterogeneity drives science improvement. Economically, it makes sense. So, if you're a life sciences company and you're going to be deploying your intervention in a population like the US or the UK, you need to ensure that your research participants are representative of your population. And it's scientifically interesting, as I say. So, for us, I think it's about representativeness. And if you want—if you're going for representative research participants, you should also be asking whether your researchers and your clinicians are representative of the population. So, I remember visiting Bradford. They've got a great cohort study called Born in Bradford, and it's very socioeconomically mixed, and with ethnicity. And they drew their researchers from the population and developed their career pathways, and that's why their participation rate's high and their insights are so relevant. So, for me, it's not about anything totemic. It's about saying, "This is research that matters and that will actually change health outcomes." And then it's—and in the UK, we've actually made research inclusion a condition of funding in the NIHR because we think it matters, and we think that it just makes for good science and good economics.

Celine Gounder 29:18

And Sharmila.

Sharmila Makhija 29:21

You know, again, I'm going to go back to the—and I probably resonate the most with Monica, understanding from that rural background that the diversity of communities that you serve are really going to drive a lot of the behavior and the work that we do. And we're in the middle of the Heartland region, and we see it. We see the issues that come about. The reason that we're building out all of this for the new health-care campus is because there's not enough access to specialty care to what the communities really need. And if you look at the poor outcomes, and we're sitting at the very bottom of every health outcome in the country in Arkansas, that is what's driving our desire to really cater what the needs are. What do we develop? What do we bring forward in our health system that will better serve our community? So, I think it's really important to understand the communities that you're in, what are the needs, and how do you create the solutions for those communities?

Celine Gounder 30:22

Lightning round just to wrap up here. Who gets to stay in science is dependent on a number of different things, but it's largely dependent on the decisions 22-year-olds may be making today. What would you say to a 22-year-old who is graduating from college and contemplating a career in biomedical science to encourage them to stay in the field?

Monica Bertagnolli 30:45

I would tell them that there's never been a more exciting time to be in biomedical science. What is happening is miracles every day, if you think about it. Science delivers miracles. But the essential feature is a human being being there to make those miracles happen and to make sure that those miracles get to the people who need it, and they can be that person.

Celine Gounder 31:18

Lucy.

Lucy Chappell 31:20

Science is the future of our health and care system. Be part of it.

Celine Gounder 31:25

And Sharmila.

Sharmila Makhija 31:27

You know, I think that it's very interesting. With any kind of challenges that we've been facing as a country, I think it brings great opportunity. And what we've been saying to our students is, “Embrace this to understand how can we do things better,” and to always stay curious, and to create something even better than we had before. So, we say it actively to our students. We talk to college students, we talk to high school kids, that this is the time to really think about going into the sciences because you can make an impact for change.

Celine Gounder 32:03

Well, I want to thank our panelists, Monica, Sharmila, and Lucy, for a great conversation.

[Applause]

Sharmila Makhija 32:08

Thank you, Celine.

Monica Bertagnolli 32:09

Thank you.

Lucy Chappell 32:09

Thank you, Celine.

Monica Bertagnolli 32:10

Thank you, Celine.

Announcer 32:13

We hope you…

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