against unintended pregnancy and highly prevalent sexually transmitted infections (STIs), such as human immunodeficiency virus type 1 (HIV-1) and herpes simplex virus type 2, has been enthusiastically endorsed by women and could boost the popularity of contraceptive methods.[5] MPT products under development include a combination of antiretroviral therapy and hormonal contraception, as well as topically delivered nonhormonal agents such as monoclonal antibodies that specifically target sperm, HIV-1, and other STIs.

An audio interview with Dr Anderson is available at NEJM org

A new contraception initiative could promote innovative strategies by leveraging recent advances in well-funded scientific fields such as HIV prevention, molecular biology, nanotechnology, and bioinformatics, among others. New contraceptive discoveries could improve the health and well-being of women and their families and could help to further reduce and stabilize human population numbers globally, offering an additional step toward rebalancing the planet and preserving its natural treasures for future generations.

Disclosure forms provided by the author are available at NEJM.org.

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Saving the Endangered Physician-Scientist — A Plan for Accelerating Medical Breakthroughs

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On July 1, 1968, at the height of the Vietnam War, four young physicians with little to no background in research reported for duty at the National Institutes of Health (NIH) to begin fulfilling their draft obligation as commissioned officers in the U.S. Public Health Service (USPHS). This intensive, 2-year experience ultimately led each of them to incorporate scientific research into their career plans as physicians. Their future accomplishments would include the discovery of oncogenes; research that led to the development of statins; the discovery of a family of receptors that now serve as the targets for one third of all drugs approved by the Food and Drug Administration; and, as a bonus, four Nobel Prizes. The four physician-scientists were Harold Varmus, Michael Brown, Joseph Goldstein, and one of us (R.L.), and their efforts would forever change science and medicine.

Physician-scientists have been a driving force in biomedical research and have made broad contributions in both the private and public sectors. Their research has led to mechanistic understanding of diseases and the development of therapies, devices, and technologies that enable current medical practice. They account for 37 of the winners of Nobel Prizes in Physiology or Medicine and numerous winners of Nobel Prizes in Chemistry. An outsized share of leaders in industry and government, including about 70 of chief scientific officers at top 10 pharmaceutical companies and NIH institute directors, hold M.D. degrees. In the past four decades, however, the proportion of U.S. physicians engaged in research has dwindled from a peak of 4.7 of the overall physician workforce in the 1980s to approximately 1.5 today.[1,2] There are numerous reasons for this trend, some of which are outlined in Table 1. Because of these changes, aspiring young physician-scientists see careers combining research and patient care as unattainable. As more people abandon this career path, the loss of role models for trainees further exacerbates the problem.

The decrease in the number of physician-scientists comes at a time when we particularly need innovations in medicine, as the population ages and communicable diseases spread more rapidly and widely. Many diseases still have unknown origins and pathways, and for precision med-

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Table 1. Issues Contributing to the Declining Numbers of Physician-Scientists.

Level	Issues
Individual	Student debt
	Child care and family responsibilities
	Increasing length of time spent in training before being independent
Institutional	Negative effects of health care finances on research support
	Reduced patient contact time that precludes evaluation of difficult cases
	Decreasing numbers of, and decreasing exposure to, physician-scientist mentors
	Insufficient protected time for research
	Absence of organized physician-scientist career-development programs across specialties
	Inflexible family-leave policies
National	Decreased or stagnant federal and nonfederal research funding
	Increased specialization in medicine and science, leading to a widening gap between clinicians and researchers
	Limited available funding for loan repayment programs, particularly for trainees in basic science disciplines
	Increasingly challenging requirements for board certification and maintenance of certification
	Lack of diversity in the physician-scientist workforce
	Discrepancies in salary and benefits offered during clinical versus scientific training, in part owing to ACGME policies

* Laudable efforts to address some of the above issues are being made by a number of organizations, including the National Institute of Health Physician-Scientist Workforce Working Group,[2] the Burroughs Wellcome Fund www.bwfund.org), and the Doris Duke Charitable Foundation www.ddcf.org). The UCLA Specialty Training and Advanced Research STAR) program also addresses some of these issues.[3] ACGME denotes the Accreditation Council for Graduate Medical Education.

icine to benefit patients, we need physician-scientists with expertise in both fundamental biology and clinical medicine.

Much has been written about the declining numbers of physician-scientists. What we believe has not been fully conveyed is a sense of urgency — the need to take action now. What was the "secret sauce" that led to the success of the "yellow berets" — the USPHS officers who served stateside during the Vietnam War era at research institutions including the NIH and Centers for Disease Control and Prevention?[4] As with most successes, innovations were the result of smart and motivated people positioned in supportive environments that allowed them to ask hard questions and pursue hard problems.

We have developed a multipronged strategy for bolstering the next generation of physician-scientists. As we take the first step toward carrying out this plan, we hope to garner support from the broader medical and scientific community.

Research careers for physicians can develop at several points along the training continuum. Initial interest is often catalyzed during medical school by exposure to intensive basic science courses and research opportunities such as formal Medical Scientist Training Programs (MSTPs) and other immersive research experiences. Although the MSTP route is a common approach, year-out programs such as those supported by the Howard Hughes Medical Institute (HHMI), the NIH, and the Sarnoff Cardiovascular Research Foundation have also demonstrated favorable results.[5] The number of year-out opportunities is limited, however, and it was recently further reduced by the suspension of the HHMI program. We support continuation and expansion of such programs in order to increase the number of students entering the physician-scientist pipeline.

Aspiring physician-scientists reach critical junctures directly after residency and fellowship. During these periods of intense clinical training, young physicians identify unmet medical challenges. Addressing such challenges by means of rigorous scientific inquiry and training with supportive mentors crystallizes the physician-scientist identity that is foundational to a sustained commitment to this dual-career path.

The next phase is the independent junior-faculty investigatorship. In this influential phase, careers dedicated to innovation are solidified. Young physician-scientists may make fundamental discoveries that transform medical practice, find new treatments for chronic medical problems, or develop technologies that save lives. However, this period also represents a particularly vulnerable time during which there is substantial attrition in the pool of academic physician-scientists. At a personal level, young physician-

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Table 2. Recommended Solutions to the Declining Numbers of Physician-Scientists.

Category	Solutions
Augment entry trainee level)	Increase basic science foundational coursework in medical curriculum
	Fund year-out research opportunities during medical school e.g., Sarnoff fellowship, National Institutes of Health Medical Research Scholars program, and Stanford's "Discovery Curriculum" and Berg Scholars program)
	Fund research opportunities during residency and fellowship, with guaranteed protected time, debt relief, and experienced mentors
Reduce attrition junior-faculty level)	Provide robust and sustained support for junior faculty
	Protect time for research
	Develop mentorship and sponsorship network within or between institutions
Increase institutional support	Create a national network of academic institutions committed to physician-scientists
	Establish physician-scientist offices
	Establish guidelines for salary, optimal balance of clinical and research efforts, and sustained research support
Other	Expand loan-repayment programs
	Improve family-leave policies and maximize child and parental care resources
	Revise requirements for board certification, maintenance of certification, and institutional credentialing

scientists must begin to pay back the considerable debt accrued during medical education, and many have increasing family responsibilities, which still represent a particularly important barrier for female physicians. At a professional level, the lack of sustained and robust research support and protected time for research tempers the ambitions of young physician-scientists. These realities can result in young faculty members pursuing less challenging research topics and eventually losing momentum and leaving research. To address these barriers, academic institutions can support faculty members studying critical problems that require time and resources. The goal is to change academic culture, making it attractive again by offering a stimulating career with job security and an opportunity to succeed in a funding environment that currently often marginalizes young investigators.

The demands of the health care system have made it increasingly difficult for institutions to support research activities. It is daunting for any single institution to address the challenges facing physician-scientists, such as those related to compensation and promotion. We propose that, as a commitment to the future of medicine, academic medical centers build a national network to support physician-scientists. Individual institutions could establish physician-scientist offices that are led by visionary faculty members who are committed to inspiring and supporting young physician-scientists and developing nurturing environments for research, thereby facilitating invention of the next generation of transformative medicines and clinical practices. A consortium of such leaders who are willing to find ways to stimulate research by physicians to address intractable medical problems will alter the trajectory of health care and improve public health. Additional potential solutions to the dwindling number of physician-scientists are outlined in Table 2.

Revitalizing the physician-scientist pipeline is of critical importance to overcoming current and future health challenges. We recently founded a 501(c)(3) nonprofit organization, the Physician-Scientist Support Foundation (www.thepssf.org), whose mission is to build a sustainable and diverse physician-scientist workforce by supporting the development of investigators who will make fundamental discoveries that improve human health. We are seeking partners who share our sense of urgency about refilling the pipeline of physician-scientists. The Vietnam War era saw the launch of a golden age of biomedical research at the NIH that spawned an entire generation of academic physician-scientist leaders whose work, in aggregate, has changed the way we prevent and treat disease. Together, we can catalyze a new golden age by cultivating and supporting the next generation of talented physician-scientists.

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Ghosts of Our Collective Subconscious — What Blackface in a Yearbook Photo Means for Medical Education

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On the medical school yearbook page of Ralph Northam, who is now the governor of Virginia, there is a photo of two figures. One wears an oversized blazer, trousers with matching bow tie, and a jauntily positioned hat. Greasy black shoe polish is slathered across his hands and face. The other figure is garbed in the white robe and conical hat of the Ku Klux Klan. Together they stand, holding beers and posing for the camera, the way a couple dressed as salt and pepper shakers might at a costume party. Underneath the photo, a caption reads "Interest: Pediatrics."

As a black medical student in California, I tuned in to the conversation about what the photo meant for Virginia politics, but I was even more interested in what it meant for medicine and medical education. As the news broke in online chat rooms where medical students of color come together, choruses of voices echoed the same concerns. If it was okay to pose in a 1984 medical school yearbook in blackface or KKK regalia, what did that say about the racial climate in which doctors in Northam's age group trained?

After citing a heart-failure study from Northam's alma mater, an attending physician said to me, "Oh, and I read about some scandal that happened there last week. Can't remember what it was." In my attending's world, Northam had been caught doing something unseemly and ultimately forgettable. In my world, he had been caught celebrating the ultimate duo of racial subjugation — dehumanizing the black body to minstrelsy for profit and terrorizing communities of color with violence — ideas Northam had found so compatible with his study of medicine that they ended up in his yearbook.

Neither my attending nor Northam sees what I see in the photo, and therein lies the problem. The fear among students of color is not that our teachers secretly hate us, but rather that we are all so bathed in a culture of racism that we are blind to the biases that lie hidden within us.

Prompted to take the implicit-association test (IAT) in my first year of medical school, I teared up at results showing that, in deciding within milliseconds who was "good," I demonstrated bias against people who looked like me, my family members, and many of my friends.[1]

The IAT is not a perfect test, but my own results remind me that even as we work toward the North Star of equity, none of us are immune to the racist beliefs that permeate the zeitgeist of our country, with its painful history of displacement, slavery, segregation, and de facto discrimination. Thus, I am on a lifelong journey to protect my patients, my colleagues, and one day my students from myself.

Battling the ghosts of our collective subconscious is maddeningly difficult. On some issues, such as diversity in medical school admissions, there is evidence that implicit-bias training results in improvement.[2] But after 20 years of diversity- and equity-training efforts, and although we have in fact diversified our medical school classes, racial minorities remain

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