often feel clueless about how to help.

As you move forward in your quests to render physics a welcoming, inclusive, diverse, and equitable field, I urge you to turn away from spending time trying to change the groups you want to welcome and instead focus on trying to transform yourself. How can you alter your admissions practices, program norms, funding equations, and assessment practices? How can you modify your syllabi, courses, and learning opportunities? What can you do to ensure that opportunity is spread evenly across the racial, gender, class, and ability groups in your institution? And most importantly, how can your institution maintain its "core" while simultaneously becoming an equity-minded organization?

In what follows, I offer a few starting points for members of the physics community who are ready to do the work.

First, if you are a leader of any kind, ask yourself where you stand on issues of diversity. The tone you set as a leader will reverberate outward in ways you do not know.

The last research I conducted as a professor at the University of Maryland in College Park was a study of what motivated the teachers who do the best jobs at challenging oppression and supporting cultural differences to remain in classrooms. I found that the single most salient factor was the teacher's relationship with the highest-ranking leader in their building. Those leaders singlehandedly set the tone for how their subordinate faculty either embraced or eschewed the importance of diversity and equity.

The best leaders had varying levels of knowledge about diversity, equity, and inclusion, but they were all in full support of what their faculty wanted or needed to do to prioritize efforts to achieve them. They often vowed to "take the hit" in meetings with superiors, external stakeholders, and others who might push back.

Second, make sure that you are showing up to the diversity and equity dialog in the right identity. I have found that we encounter difficulty when white people who have experienced hardships such as poverty or discrimination because of their religion or parents' birthplace show up to the racial dialog not as white people but as *marginalized* white people. But when people who are white or pass as white enter conversations about race in one of those other identities, they miss the opportunity to take advantage of the power that their whiteness provides in the fight to dismantle racism.

It's the same for men. Are there men who face challenges of injustice and inequity? Yes. But when women need male allies to advocate for their presence as tenured faculty, to be the first authors on their papers, or to negotiate fair salaries for them, they need men to show up as *men* who are aware of the power their gender confers.

Third, make space for your students to share their stories. Some members of the scientific community possess a deeply dangerous sentiment that their work is somehow objectively outside the purview of social-justice issues, racism, inequity, and unfairness. I've noticed a serious hesitation among educators to discuss such topics in their classrooms.

But when I was attending Harvard University as a low-income student from a rural area, the biggest challenges I had to surmount had nothing to do with the one my peers found the most difficult: the curriculum. I found it much harder to deal with racist, sexist, classist classmates and faculty members than with my Moral Reasoning course.

When I was a student, the academics themselves were never the challenge for me. It was the sociopolitical context of my learning that always battered me, hampered me, and made my time in school far more arduous than it ever had to be. If professors, teachers, and scientists are actively shying away from discussing with students the issues that affect their lives in real time, then what kind of educating are they doing?

As a college professor, I began every class with a check-in. If students wanted to discuss racial tensions in and out of the classroom, the latest verdict of a high-profile case, or news from the White House, I made space for that. For them. For their stories.

I implore you to listen to your students whose voices long to be heard in class. I invite you to study your syllabi meticulously to see where people from different types of backgrounds are erased or fully present. I challenge you to look around your classroom and in your presentation slides for representations of not only the students who are in the room but also the students you say you so desperately want to attract. And most importantly, I encourage you to learn the history of yourself, your family, and your identities so you can juxtapose your stories with the new ones you absorb. We all have quite a lot to learn from one another's stories, and that's OK.

I have seen the value of welcoming all people to the struggle for diversity, equity, and inclusion, regardless of their identities or their hesitancies about joining.

We need *everyone* at the table. Thank you for showing up.

References

1. M. C. McGarrity, *Confronting Violent White Supremacy (Part II): Adequacy of the Federal Response*, statement before the US House Committee on Oversight and Reform, Subcommittee on Civil Rights and Civil Liberties, 116th Congress, 4 June 2019, p. 8.
2. L. Zheng, "How to show white men that diversity and inclusion efforts need them," *Harvard Business Review*, 28 October 2019.

Taharee Jackson
(drtaharee@gmail.com)
DrTaharee Consulting
Alexandria, Virginia

CONTACT PHYSICS TODAY

Letters and commentary are encouraged and should be sent by email to **ptletters@aip.org** (using your surname as the Subject line), or by standard mail to Letters, Physics Today, American Center for Physics, One Physics Ellipse, College Park, MD 20740-3842. Please include your name, work affiliation, mailing address, email address, and daytime phone number on your letter and attachments. You can also contact us online at **https://contact.physicstoday.org**. We reserve the right to edit submissions.

LETTERS

Contributions to computed tomography

As I started reading the article on computed tomography (CT) by John Boone and Cynthia McCollough (Physics Today, September 2021, page 34), I expected to see Allan Cormack mentioned early on. Instead, only in box 1 is it noted that he shared a 1979 Nobel Prize with Godfrey Hounsfield. Cormack was the first to demonstrate the feasibility of x-ray CT through mathematical derivation and experimental validation. His investigations in that area, done with little or no funding, began in 1956 in South Africa, where he was assigned to a Cape Town hospital to oversee their radioactive sources. Observing how crudely radiotherapy planning was done at that time, he wondered if it would be possible to determine the internal inhomogeneities of each patient to improve their individual treatment plans.

In his 1964 paper, Cormack experimentally demonstrated the CT principle.[1] He built a hand-operated scanner to measure the attenuation of a cobalt-60 beam as it passed through an object along paths at various angles, referred to now as translate–rotate geometry and shown in figure 1a of Boone and McCollough's article. Using data collected over a two-day period, he reconstructed the scanned object's attenuation-coefficient profiles along several lines through the object and showed that, aside from some slight ringing artifacts, the reconstructed values matched the known values. Those profile plots demonstrated that he had achieved his goal of determining the attenuation values inside an object from its x-ray attenuation measurements.

Cormack, in his 1963 paper, presciently suggested the application of his work to two other modalities: positron emission tomography and single-photon emission computerized tomography, commonly referred to as PET and SPECT, respectively, which are frequently performed in the clinic today.[2] Prompted by an earlier suggestion by Robert Wilson that protons could be useful in medicine,[3] Cormack was especially interested in the promise of proton CT, which is currently being investigated for proton-therapy treatment planning.[4]

References

1. A. M. Cormack, *J. Appl. Phys.* **35**, 2908 (1964).
2. A. M. Cormack, *J. Appl. Phys.* **34**, 2722 (1963).
3. R. R. Wilson, *Radiology* **47**, 487 (1946).
4. K. Hanson, U. Schneider, *Z. Med. Phys.* **32**, 2 (2022).

Kenneth M. Hanson
(kmh@hansonhub.com)
Los Alamos, New Mexico

I would like to add a historical footnote to the excellent article by John Boone and Cynthia McCollough in the September 2021 issue of Physics Today (page 34). The origins of computed tomography (CT) can be traced to William Oldendorf's pioneering work in the late 1950s and 1960s. Oldendorf was a professor of neurology at the UCLA School of Medicine when he developed a prototype of an automated tomographic device in which he used his son's electric train set, a phonograph turntable, an alarm clock motor, and other household items. It was the first demonstration of "a radiographic method of producing cross-sectional images of soft tissue by back-projection and reconstruction."[1]

In his 1961 breakthrough paper, Oldendorf laid out CT's basic concept,[2] which Allan Cormack later used to develop its underlying mathematics. In October 1963 Oldendorf received a US patent for a "radiant energy apparatus for investigating selected areas of the interior of objects obscured by dense material."[3]

The 1975 Albert Lasker Clinical Medical Research Award recognized the importance of Oldendorf's contributions to discoveries that enabled CT. He shared the prize with Godfrey Hounsfield, who with Cormack would receive the Nobel Prize in Physiology or Medicine four years later for "the development of computer assisted tomography."

Some have speculated that Oldendorf was on the original Nobel announcement but was removed at the last minute at the behest of certain members of the Nobel Assembly at the Karolinska Institute, which votes on the nominating committee's recommendations. It is possible some assembly members felt that the inclusion of a clinician would cheapen the award, making it appear overly pragmatic and thereby reducing its prestige.[4]

Oldendorf gave a lecture at UCLA shortly after the Nobel announcement was made. In it, he reviewed the work that earned him a Lasker and should have made him a Nobel laureate. Everyone who heard Oldendorf's presentation that day (myself included) came away convinced he was unjustly deprived of the pinnacle of scientific recognition. Readers wanting to learn more about Oldendorf's contributions to tomography and their historical context should consult his book on the topic.[5]

References

1. L. J. West, J. C. Mazziotta, A. Yuwiler, in *University of California: In Memoriam, 1993*, University of California Academic Senate (1993), p. 133.
2. W. H. Oldendorf, *IRE Trans. Biomed. Electron.* **8**, 68 (1961).
3. W. H. Oldendorf, "Radiant energy apparatus for investigating selected areas of the interior of objects obscured by dense material," US Patent 3,106,640 (8 October 1963).
4. W. J. Broad, *Science* **207**, 37 (1980).
5. W. H. Oldendorf, *The Quest for an Image of Brain: Computerized Tomography in the Perspective of Past and Future Imaging Methods*, Raven Press (1980).

Steven Greenberg
(steven@siliconspeech.com)
El Paso, Texas

▶ **Boone and McCollough reply:** We appreciate and agree with the comments from Steven Greenberg and Kenneth Hanson regarding our article, "Computed tomography turns 50." While writing it, we realized that so many people were involved in the development of modern computed tomography (CT), starting with Johann Radon in 1917, that we couldn't mention them all in our limited space. So we chose to mention only the few who were intricately involved early on in the clinical translation of CT—which is what the 50th anniversary celebrated. Many others could be mentioned for their contributions to CT technology, of course, and after our article was published, we received some wonderful anecdotes from those who were involved in the early days of CT.

We also learned that another, more comprehensive 50-year tribute[1] to CT was published around the same time as our Physics Today article. In summary, we concur with Greenberg's and Hanson's recommendations that many others deserve credit for CT.

Reference

1. R. A. Schulz, J. A. Stein, N. J. Pelc, *J. Med. Imaging* **8**, 052110 (2021).

John M. Boone
(jmboone@ucdavis.edu)
University of California, Davis
Cynthia H. McCollough
(mccollough.cynthia@mayo.edu)
Mayo Clinic
Rochester, Minnesota