

mass”—all of the matter embedded in inanimate solid objects made by humans—is estimated to already exceed the total biomass.⁵

The implications of such ideas are both fascinating and concerning. We know that if the resources demanded by our global civilization are not balanced against their environmental impacts, we'll suffer. At the same time, the vast, externalized informational world that we generate and sustain—an entity that I have dubbed the “dataome” in my 2021 book *The Ascent of Information: Books, Bits, Genes, Machines, and Life's Unending Algorithm*—has helped make us one of the most successful and sophisticated species Earth has ever seen. We've engineered an astonishing amplification of biological traits by off-loading memory, communication, and problem-solving to other places, outside of our cells and genes.

Maybe we can innovate our way out of informational meltdown. Some people pin (perhaps unrealistic) hopes to the realization of more generalized quantum computing. But while qubits use little energy to compute, their environmental conditions require significant power. As of 2015 the hardware of a D-Wave Systems machine consumed about 25 kilowatts of power, much of which was used to maintain refrigeration.⁶ It's still unclear how that will scale further. But no matter what, the infrastructure and exponential growth of data storage and retrieval required will remain a burden.

Humans may have catalyzed the rise of a dataome and a world increasingly structured and restructured in service of information, but it's not obvious that the extraordinary benefits we enjoy will continue to outweigh the burdens. The big question is where that problem takes us.

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.

Explaining biological evolution has benefited from the concept of the selfish gene, whose ability to propagate relies not on the advantage it bestows but on its ability to enhance its own transmission. The dataome suggests that those resource-seeking informational forms can spill like a tsunami into other domains and follow thermodynamic imperatives that are indifferent to parochial human needs, dissipating energy until our planet's contents are once again in equilibrium with the rest of a cold cosmos.

References

1. E. D. Williams, R. U. Ayres, M. Heller, *Environ. Sci. Technol.* **36**, 5504 (2002).
2. E. Strubell, A. Ganesh, A. McCallum, in *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*, A. Korhonen, D. Traum, L. Màrquez, eds., Association for Computational Linguistics (2019), p. 3645.
3. M. Hilbert, P. López, *Science* **332**, 60 (2011).
4. Semiconductor Industry Association, Semiconductor Research Corp, *Rebooting the IT Revolution: A Call to Action* (September 2015).
5. E. Elhacham et al., *Nature* **588**, 442 (2020).
6. J. Hsu, “How much power will quantum computing need?,” *IEEE Spectrum*, 5 October 2015.

Caleb Scharf

(caleb@astro.columbia.edu)

Columbia University

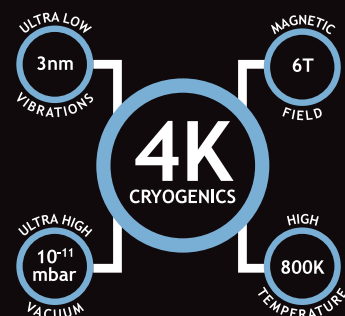
New York City

LETTERS

Reviewing Trump's relationship with science

The criticisms by Wallace Manheimer, Christopher Barsi, and Joseph Moody (PHYSICS TODAY, June 2021, page 10) of David Kramer's excellent, entirely fact-based report, “The undermining of science is Trump's legacy” (March 2021, page 24), demand a response. The writers attack Kramer and imply that he wrote a political opinion piece. Nothing could be further from the truth. Kramer's report is good science journalism, focused on what highly respected scientists and former presidential advisers have said about Donald Trump's impact on science, particularly with respect to the role of facts and fact-based decision

CRYOSTATS FOR THE QUANTUM ERA



APS March Meeting
Booth #709



Advanced
Research Systems
ARSCRYO.COM

making. It illustrates each issue with facts and examples.

Kramer accurately describes Trump's handling of the pandemic as an example of his undermining of science. Trump did in fact sideline Anthony Fauci and Deborah Birx, a well-documented fact attested to by both doctors. Moody asks, "Has there ever been a more aggressive effort to impede the spread of a virus?" Such a question is ludicrous on its face. Trump, who at one point admitted to downplaying the pandemic, was the loudest voice in the nation denying the effectiveness of masks and pushing back against social distancing.

Moody says that "most any unbiased individual would applaud Trump for seeking a variety of opinions." But seeking a variety of opinions on a scientific or medical subject shouldn't entail amplifying the opinions of those with no background or training in the area, as Trump did with Scott Atlas, a radiologist with no expertise in infectious disease, virology, epidemiology, or statistics.

Barsi claims that Kramer conflates science with "his personal preference for the

government planning of scientific research." But the story does no such thing. Kramer reports on a public issue—namely, Trump's legacy in science. He does not advocate for government funding of scientific research. Barsi accuses Kramer of imposing his views of the 2015 Paris Agreement, but the piece does not do that either. Rather, it straightforwardly reports on the fact that Trump's climate actions were not based on facts and science, thus illustrating how Trump damaged the position of science in the nation.

Certainly, COVID-19 vaccines were developed extraordinarily quickly during the Trump presidency, as Manheimer notes. But that has nothing to do with the damage Trump has done to science and the respect for science in the US, through multiple instances of his refusal to acknowledge facts and the role science must play in public policy, no matter how uncomfortable that may be. Kramer is to be congratulated for his straightforward, fact-based account of that damage.

H. Joel Jeffrey

(joe.jeffrey@gmail.com)
Wheaton, Illinois



David Kramer's powerful report "The undermining of science is Trump's legacy" (PHYSICS TODAY, March 2021, page 24) elicited responses like Wallace Manheimer's letter in the June 2021 issue (page 10). Manheimer complains that Kramer's story was too political, but then he launches into a highly politicized and inaccurate portrayal of Donald Trump's legacy.

The letter touts a rise in R&D funding that occurred during Trump's presidency. But that increase was the result of repeated congressional actions to reject draconian cuts that the Trump administration attempted to impose on critical R&D funding. Recall the outrageous efforts by Trump's Health and Human Services secretary Tom Price (before he was forced to resign because of corruption) to reduce the National Institutes of Health budget by almost \$6 billion through cutting funding for universities' and research institutions' overhead expenses.

With regard to the vaccine achievement that Manheimer says Trump "spearheaded," the former president's lasting legacy is unfortunately his politicization of the vaccine development process in an effort to influence the outcome of the 2020 presidential election. While heroic scientists across the US and the world were working around the clock to achieve extraordinary results with COVID-19 vaccines, Trump was busy mocking the wearing of masks, promising without any basis that the virus would disappear, and pitching ineffective and dangerous therapeutics.

Jeffrey Borenstein

(jborenstein@partners.org)
Harvard Medical School
Boston, Massachusetts

Corrections

January 2022, page 17—The report incorrectly described Earth's distance from Messier 51. It is more accurate to say that it is about 400 times as distant as the far edge of the Milky Way's disk.

January 2022, page 37—In figure 2, the legend should indicate that the blue circle represents Earth's orbit and the red circle represents Mars's. A corrected figure can be found online. **PT**

sensitive.

Superb sensitivity for lasers with linewidths down to 2 kHz

LWA-1k Series

Linewidth Analyzer

High resolution lineshape spectra and ultra sensitive noise analyzers for narrowband lasers.



Enter a new world
of accuracy!



www.toptica.com/highfinesse