Woke invades the sciences

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A quarter-century ago, the "Science Wars" — an unfortunate military metaphor applied to an intellectual debate — pitted a motley crew of postmodernist-influenced literary scholars and social scientists, often (but not always) of a leftist and feminist political bent, espousing an extreme social-constructivist view of science and scientific knowledge, against another motley crew of scientists and philosophers (plus some humanities scholars, historians and social scientists) from across the political spectrum, who defended traditional notions of rationality and objectivity, at least as ideals towards which to strive.

Some leftist scientists, it is true, such as Richard Lewontin and Stephen Jay Gould, did advocate social-constructivist theses with regard to particular (and highly controversial) items of scientific study, notably human intelligence; and some feminist scientists, such as Ruth Hubbard and Evelyn Fox Keller, did the same with regard to other corners of biology and psychology. But no prominent scientists, as far as I know, endorsed the radical view that *all* purported scientific knowledge — from neutrino physics to organometallic chemistry to lepidopterology — is deeply imbued with social ideology. Nor did any notable scientists advocate social constructivism with respect to long-established and uncontroversial items of scientific knowledge, such as the atomic theory of matter or the double-helix structure of DNA.

That, alas, has changed — at least on certain subjects. (Maybe you can guess which ones.)

One classic of the earlier era was sociologist Andrew Pickering's book *Constructing Quarks* (1984). That book provided a superb and extraordinarily detailed history of modern elementary-particle physics, sandwiched between initial and final chapters of (let me be blunt about my view) astonishingly poor philosophy. On the basis of that philosophy, Pickering concluded that

> there is no obligation upon anyone framing a view of the world to take account of what twentieth-century science has to say. ... World-views are cultural products; there is no need to be intimidated by them. (413–414)

Dare I say that this is grossly misguided? Of course our *ideas* about quarks are a human historical and social construction — that is a truism — but there is good reason to believe that the quarks themselves have existed ever since the Big Bang, roughly 13.7 billion years ago.

But the reasons justifying that belief are subtle. Quarks are not, after all, directly observable. Neither, of course, are dinosaurs; all we can observe are their fossils. But dinosaurs are (or rather, were) mid-sized macroscopic objects, and we can easily imagine what they looked and behaved like, by analogy with contemporary animals that we are able to observe today. So we certainly have good reason to believe that there existed, at some time in the past (roughly 240 to 65 million years ago), the animals that we call dinosaurs.

Subatomic particles like quarks, by contrast, are very far from our everyday experience, and their behavior is extraordinarily strange. Quantum mechanics was invented

by Schrödinger and Heisenberg in 1925 — next year will be the centenary — but no one today, I think, really *understands* what quantum mechanics is telling us about the fundamental nature of the universe. (Or to put this in the first person: I have been studying quantum mechanics for slightly over half that century; and the more I learn about it, the less I understand.) And yet, quantum electrodynamics can predict the magnetic moment of the electron to 11 decimal places accuracy: "equivalent to measuring the distance from Los Angeles to New York ... to within the width of a human hair", as Nobel laureate Richard Feynman memorably put it.

Quarks are, in fact, even more subtle than electrons. Electrons are too small to be directly "seen", but at least we can observe their tracks in bubble chambers. But our best contemporary theories tell us that free quarks cannot exist; they are always bound within other elementary particles, such as protons and neutrons. Their existence and behavior must be inferred by a complicated chain of reasoning involving both experiment and theory. The general outlines of that reasoning can be explained to the lay reader — though the details require advanced mathematics and a deep knowledge of physics — but even at a general level it is indubitably subtle.

Fast forward four decades. Now the entire American medical establishment, from the American Medical Association and the American Academy of Pediatrics to the American Psychological Association and the American Psychiatric Association and even the Centers for Disease Control and Prevention, insists that sex — as in male or female — is, in the AAP's words, "an assignment that is made at birth". What could this mean?

The facts about sex are straightforward, and are taught in any half-decent high-school course in biology. Nearly all animals, as well as many plants, reproduce sexually. In almost all sexually reproducing multicellular species this occurs by combining a large gamete, called an ovum (or egg), with a small gamete, called a sperm. Though some ("hermaphrodite") plants and animals produce both ova and sperm, there are no hermaphrodite mammalian species. In mammals, each individual produces only one kind of gamete. Those individuals that produce (relatively few) ova are called female; those that produce (large numbers of) sperm are called male. Whether a mammal embryo develops into a male or a female is determined (at least when things go right, which is nearly all the time) by a pair of sex chromosomes: XX for females, XY for males.

In short, sex in all animals is defined by gamete size; sex in all mammals is determined by sex chromosomes; and there are two and only two sexes: male and female.

For sure, quirks of mutation or prenatal development may leave some individuals unable to produce viable gametes at all. But an infertile individual with a Y chromosome is still male, just as a one-legged person remains a full member of our bipedal species.

Much is speciously made of the fact that a very few humans are born with chromosomal patterns other than XX and XY. The most common, Klinefelter syndrome (XXY), occurs in about 0.1% of live births; these individuals are anatomically male, though often infertile. Some extremely rare conditions, such as de la Chapelle syndrome (0.003%)

and Swyer syndrome (0.0005%), arguably fall outside the standard male/female classification. Even so, the sexual divide is an exceedingly clear binary, as binary as any distinction you can find in biology.

So where does this leave the medical associations' claims about "sex assigned at birth"?

A baby's name is assigned at birth; no one doubts that. But a baby's sex is not "assigned"; it is determined at conception and is then *observed* at birth, first by examination of the external genital organs, and then, in cases of doubt, by chromosomal analysis.[1] Of course, any observation can be erroneous, and in rare cases the sex reported on the birth certificate is inaccurate and needs to be subsequently corrected. But the fallibility of observation does not change the fact that what is being observed — a person's sex — is an objective biological reality, just like their blood group or fingerprint pattern, not something that is "assigned". The medical associations' pronouncements are social constructivism gone amok — this time about a subject that has been more-or-less accurately understood by humans (albeit without all the scientific details) ever since the beginning of our species. Sex, unlike quarks, is not subtle.[2]

What could have impelled sober-minded scientists to advocate such an easily refutable view? The cause is evidently political. The medical establishment's new-found reluctance to speak honestly about biological reality — and its insouciance in speaking dishonestly about it — presumably stems from a laudable desire to defend the human rights of transgender people. But while the goal is praiseworthy, the chosen method is misguided. Protecting transgender people from discrimination and harassment does not require pretending that sex is merely "assigned".

The bottom line is this: It is never justified to distort the facts in the service of a social or political cause, no matter how just. If the cause is truly just, then it can be defended in full acceptance of the facts about the real world; if that cannot be done, then the cause is not just.

And when an organization that proclaims itself scientific distorts the scientific facts in the service of a social cause, it undermines not only its own credibility but that of science generally. How can the public be expected to trust the medical establishment's declarations on other controversial issues, such as vaccines — issues on which the medical consensus is indeed right — when it has so visibly and blatantly misstated the facts about something so simple as sex?

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[1] Alice Sullivan has kindly drawn my attention to data showing the sex ratio at birth, in various countries, from 1950 to 2021. In several countries, mostly in Asia and Central Asia, there has been, since the mid-1980s, a huge preponderance of boys over girls, reaching a peak ratio 118:100 in China in 2005 (it has now decreased to 112:100). The obvious cause of this disparity is the cultural preference for boys, combined with the availability of sex-selective abortion. And the latter is possible precisely because sex is determined at conception and is observable *in utero*, well before it can be "assigned" at birth. (Indeed, aborted fetuses, which are never born, also have a sex: in some countries preferentially female.)

[2] Of course, the *effects* of sex on the organism are incredibly subtle — as is just about everything in biology — and this has engendered all sorts of confusions, even among well-meaning biologists. But the complexity of the *effects* of sex does not change the fact that the basic *concept* of sex is easy to grasp; indeed, it is uncontroversially understood by all humans over the age of 7 or so, except perhaps those in some university departments.

One might respond to this by observing that medicine is not, strictly speaking, a science: rather, it is an applied field that combines biological science with psychological and social notions of highly variable rigor. And it is from this latter side that politics has entered and has taken precedence over truth.

So it is fair to ask: Are there any examples of similar politicization corrupting physics, chemistry or biology?

In Galileo's time, physics and astronomy were subjects of political-theological dispute; but for the past two centuries, it is principally biology that has been on the firing line. For a long time, religious conservatives were loath to accept the fact that biological species, including humans, have evolved over time — much less to accept Darwin's explanation of that evolution by natural and sexual selection. Those anti-evolution views continue to be strong in the USA, as well as in some parts of the Muslim world, and the resulting political pressure distorts the teaching of biology in the public schools. But the effect on research and teaching in the universities is minimal.

Nowadays the pressure on research and university-level teaching in biology comes principally from the "left" (I use the quotation marks advisedly), and until recently it concerned mainly the investigation of statistical differences in human traits (especially psychological traits) by sex or geographical ancestry (a.k.a. "race"). But now even mentioning sex as a biological fact can elicit a Twitterstorm of condemnation. And the main victims, not surprisingly, are researchers with untenured, precarious contracts. (Superstars like Richard Dawkins and Steven Pinker are "too big to be cancelled"; campaigns against them are intended as a warning to others.)

Harvard biologist Carole Hooven, a much-praised (but untenured) lecturer in the Human Evolutionary Biology department and author of an acclaimed book on testosterone, got herself into hot water when she dared to say on national television that

> The facts are that there are ... two sexes ... male and female, and those sexes are designated by the kinds of gametes we produce ...

Though she stressed that

> we can treat people with respect and respect their gender identities and use their preferred pronouns, so understanding the facts about biology doesn't prevent us from treating people with respect ...

this didn't stop the graduate-student director of her department's Diversity, Inclusion and Belonging Task Force from lambasting (on Twitter, of course) Hooven's remarks as "transphobic and harmful", adding that

> [T]his dangerous language perpetuates a system of discrimination against non-cis people within the med system. It directly opposes our Task Force work that aims to create a safe space for scholars of ALL gender identities and sexes.

To make a long story short, Harvard's administrators failed to defend Hooven's reputation or even her academic freedom — issuing the usual weaselly two-sided statements — and 18 months later Hooven resigned.

A similar fate befell Penn State University postdoctoral researcher Colin Wright, who dared to author an article arguing that the observed statistical sex differences in human behavior are probably at least in part grounded in evolution, and that — even more shockingly, it seems — there are two sexes, male and female, and over 99.98% of all humans belong unambiguously to one or the other. (Wright also had the audacity to draw the perceptive analogy between Blank Slate views of human behavior and the Catholic Church's acceptance of biological evolution in general while insisting that "the human soul (however defined) had been specially created and thus has no evolutionary precursor".) To make matters worse, Wright later co-authored an essay entitled "No One Is Born in 'The Wrong Body' ". He recounts the story of his "lived experience":

> In October 2019, following the publication of that second article, I received word that someone had posted a new listing in EcoEvoJobs, the largest job board in my field, that read, "Colin Wright is a Transphobe who supports Race Science." This was during the height of the academic-recruitment season. The post was eventually removed by the board operator. But there was no telling how long it was up or how many of my colleagues had seen it. ... At the time, I had nearly a hundred job applications being reviewed by search committees. I locked my Twitter and resolved, once again, to lay low.
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> But of course, I fell off the wagon. If you're looking for common characteristics among those of us who get targeted for cancelation, it isn't money or privilege. Rather, many of us simply have an inability to mumble slogans we know aren't true. Over time, we become exasperated with dishonest propaganda that masquerades as social justice, and we speak out. It's a habit rooted in the truth-telling, whistle-blowing impulse that, not so long ago, progressives applauded.
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> I broke my Twitter silence on Valentine's Day, 2020, when the Wall Street Journal published an essay I'd co-authored with developmental biologist Dr. Emma Hilton, titled *The Dangerous Denial of Sex*. Although constrained by the space limitations of the op-ed format, Dr. Hilton and I were able to briefly outline the science of biological sex, and detail how its denial harms vulnerable groups, including women, gay men, lesbians, and, especially, gender non-conforming children. Even more than other pieces I'd bylined, this one unleashed a tidal wave of online hate — perhaps because we'd pricked the precious conceit that gender ideology saves children instead of harming them. Several Penn State professors publicly denounced the essay as transphobic. Students and faculty complained to my department's diversity committee that I'd launched "a personal attack on individuals with non-binary gender identity," and that my presence at PSU "made them feel less comfortable."

The activists (possibly a very small but loud group) now became more explicit in their attempts to intimidate any university foolhardy enough to offer Wright a job. Two months later,

> I chose to leave academia. To give credit to Penn State, I was not fired. In fact, I had the opportunity to extend my fellowship contract for another year. However, I no longer believed that any amount of hard work or talent on my part would lead to a tenure-track academic job in the current climate. Nor did I want to spend my time constantly responding to false accusations of transphobia and racism. I had

> embarked on this journey because I love science, and wanted to help beat back the forces of pseudoscience in the public sphere. But that project is impossible when scientists themselves have become intimidated by small clusters of activists who demand that the scientific method be subordinated to magical thinking, and who seek to ruin the lives of those who dissent. If you follow in my footsteps, you can expect to receive similar treatment.

But as Hooven and Wright are at pains to emphasize, the harm arising from this politicization of scientific inquiry is not just — or even primarily — the manifest injustice done to researchers like themselves. Rather, the principal harm is done to the scientific endeavor itself: by inducing researchers to self-censor as a matter of personal and professional preservation, "cancel culture" undermines the freedom of debate that is the cornerstone of the scientific community's claims to knowledge. As John Stuart Mill pointed out a century-and-a-half ago, giving the example of Newtonian mechanics,

> The beliefs which we have most warrant for have no safeguard to rest on, but a standing invitation to the whole world to prove them unfounded. If the challenge is not accepted, or is accepted and the attempt fails, we are far enough from certainty still; but we have done the best that the existing state of human reason admits of ... This is the amount of certainty attainable by a fallible being, and this the sole way of attaining it.

When that freedom of debate is curtailed, even true ideas stop being rationally justified. (I will elaborate on this point in a subsequent article.)

In the physical sciences, by contrast with the biological sciences, the main attacks on the freedom of research have come from right-wing politicians attacking climate science and environmental science and attempting to defund them. This threat seems to have receded somewhat in recent years, as conservative politicians have mostly retreated from questioning anthropogenic global warming and have focussed instead on the allegedly excessive cost of transition to a non-carbon economy. But it could resurge if Donald Trump wins the next American election.

There is also some pressure on the physical sciences and mathematics from the "woke left", but at present it is mainly concerned, not with the content of research, but with vague calls for the "decolonisation" of curricula and for "decentering whiteness and cisheteropatriarchy" in pedagogy.

It's tolerably clear what "decolonisation" can mean in history and literature, but it's less clear what it might entail in the natural sciences and mathematics, which purport to produce — and in my view *do* often produce — universally valid knowledge. Some advocates of "decolonisation" take the radical position that scientific and mathematical knowledge is not in fact universally valid: for instance,

> [U]nique forms of racism and cisheteronormativity are insidiously reinforced through ideological constructions of STEM as neutral. Such neutrality is a function of objectivity and depoliticization as epistemological values in science ...

(numerous similar citations can be found in this article).

In New Zealand this postmodernist idea has now become official policy. The National Curriculum explicitly mandates "equal status for mātauranga Māori [Maori knowledge]", asserting that it has "equal value with other bodies of knowledge", presumably including modern science. Indeed, the chemistry curriculum was revised to include the concept of *mauri* — the "life principle, life force, vital essence" and "the binding force between the physical and the spiritual" — that students are taught "is present in all matter". As one chemist perceptively commented:

> Who discovered this binding force between the physical and the spiritual? And what evidence was involved in its discovery? If this binding force is real, then everyone needs to know about it. It needs to be in the chemistry syllabus of every country, not just in New Zealand.

(It now appears that the inclusion of *mauri* in the chemistry curriculum was quietly rolled back after protests from scientists.)

Other advocates of "decolonisation" accept the universality of scientific knowledge but simply urge greater attention, in teaching, to the non-Western origins of much mathematics and science. That is a sensible suggestion: for instance, every mathematician knows that the concept of zero as a number arose in India in the fifth century CE, and that algebra (*al-jabr*) was developed by Islamic scholars starting around 800 CE, before being elaborated in Renaissance Europe; students deserve to know that too. But the main focus of science and mathematics teaching has to be on our subject (in which we lecturers can rightly claim some expertise), not on its history (in which most of us are rank amateurs). Students who want to pursue the history of science should learn it from professional historians of science: learning "how to think like historians and how to critique theories such as decoloniality rather than simply accepting them as fact", as one critic put it.

One final aspect of "decolonisation" is the proposal to rename the contributions of scientists whose behavior is now considered to be morally lacking, or whose extrascientific ideas are now considered to be offensive: Isaac Newton (allegedly benefited from colonialism), Fritz Haber (developed chemical weapons) and William Shockley (racism and eugenics), among many others. The downsides of such "cancellations done in the name of maintaining moral purity" — which in earlier epochs targeted Marie Curie (affair with a married man) and Alan Turing (gay) — were eloquently explained in a recent article, "The peril of politicizing science", by the chemist Anna Krylov.

What about decentering whiteness and cisheteropatriarchy in teaching? One article on "dismantling whiteness" in physics teaching was published recently in the journal *Physical Review Physics Education Research*: this is the section of the prestigious *Physical Review* devoted to "experimental and theoretical research relating to the teaching and learning of physics and astronomy". I won't enter into the details of the article; see here for a thoughtful and balanced critique. More interesting is what happened when four physicists took up the editors' invitation to contribute "constructive and respectful criticism of published articles" — referring specifically to this one — "in the form of Comments". The four authors' duly submitted Comment — which you can read here — was *rejected* by the PRPER editor on the grounds that it was "framed from the

perspective of a research paradigm that is different from the one of the research being critiqued". As the authors dryly but accurately pointed out:

> This is akin to stating that an astronomer must first accept astrology as true before critiquing it. Such notions should be, at a minimum, dispiriting for anyone who sees educational practices as worthy of empirical investigation.

So, have the ideologues of Critical Social Justice overrun the science faculties with their cultural revolution? Are we cisheteropatriarchal scientists soon to be sent off to shovel dung with the peasants?

No, of course not. The barbarian hordes are not storming our laboratories, not yet anyway. But while apocalyptic dystopian fantasies are unwarranted, there is indeed serious cause for worry in the trend toward the politicization of science, particularly in the biological sciences and medicine. For instance, recently promulgated guidelines at the prestigious journal *Nature* arrogate to the editors the right to "refuse publication of (or retract post-publication)" any article, not because it is scientifically flawed or unimportant, but simply because in the judgment of the editors it

> undermines — or could reasonably be perceived to undermine — the rights and dignities of an individual or human group on the basis of socially constructed or socially relevant human groupings.

That vague and subjective language is an open door to ideological censorship of valid scientific contributions, and it is not alarmist to fear that such censorship will increase in the future. I plan to write more about this danger in a subsequent article.

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