

When Knowledge Institutions Pollute: Cultivated Meat, Science Communication, and Public Policy

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On May 22, 2023 the University of California, Davis media office highlighted a study on the climate impact of cultivated meat, meat grown from animal cells in a bioreactor. The study made the surprising claim that if scaled up cultivated meat's climate impact could be twenty-five times worse than that of retail beef. The research, which was posted as a preprint and hadn't yet passed peer review, then exploded in popularity, appearing almost immediately across mainstream outlets globally. The press release and preprint became significant components of cultural and political campaigns against cultivated meat, where the study was used to undermine one of its main perceived benefits, comparatively low climate emissions. Together they were often cited to help justify government regulation against cultivated meat.

In this context, this paper will argue, the UC Davis press release was tantamount to throwing a match on a tinderbox. The imprimatur of the University of California conferred a reputational boost to the preprint's life cycle analysis. No doubt the preprint would have attracted attention anyway, but the university's implicit endorsement and special access to distribution platforms dramatically increased its prominence. Pushing it into the mainstream legacy media, the university's hyped information became cemented into accepted background knowledge on the topic, enough so that any epistemically responsible inquirer would come to believe its claims. Meanwhile, the press release and preprint were explicitly mentioned in public policy arguments and legislation restricting the production or purchase of cultivated meat. While it would be a mistake to overstate the importance of one press release in what is an evident social divide, there is little doubt that it played a significant role in the debate about cultivated meat.

In what follows I'll trace this role and use it to motivate better practices in university news offices. Knowledge institutions, like universities, play an indispensable role in any functioning democracy. However, as many have noted, especially in the context of research funding, the university can be weaponized as an agent of misinformation.

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By funding research likely to produce favorable outcomes, vested interests can favorably shape the evidential landscape. This influence can delay the adoption of policy that is beneficial to the public (see Hiltner et al 2024, Legg et al 2021, Michaels 2019, Oreskes and Conway 2010). The present article illustrates how an often neglected university action — the press release — is another location of vulnerability to promoting misinformation. In this case there seems to be no strong vested interest, such as an industry, pulling the strings to get the outcomes it prefers. Instead an *epistemically polluted ecosystem* produces a stew of misinformation by blending the different vested interests of scientists, press officers, universities, and journalists. Added to the right cultural conditions, the outcome can have the same effect on public policy as when single powerful vested interests influence science. Although responsibility for this epistemic pollution is distributed, that does not imply the different agents involved don't have duties to mitigate its production. Focusing on universities, I conclude with an argument that they have an obligation to better regulate their press offices.

1 Background

Cultivated meat — also known as lab-grown meat, cell-cultivated meat, and animal cell-based meat — is produced by taking stem cells from an animal and growing them in a bioreactor. The cells are immersed in a nutrient-rich medium that triggers the cells to differentiate into the types of structure that compose meat, such as muscle, fat, and connective tissue. Within two months the cells can be harvested. In principle, any type of meat can be cultivated. At the time of writing cultivated meat has been approved for sale to humans in Australia (quail), New Zealand (quail), Singapore (beef, chicken, duck, quail), Israel (beef), and the United States (chicken, pork fat, salmon), and approved for sale to pets in the UK (chicken). There are over a hundred companies pursuing its creation.¹

Currently consumers cannot find it for sale except as a kind of niche product in a few locations. There are two major reasons for the limited release: one is regulatory, as cultivated meat lacks safety approval in most countries, and the other is efficiency, for to scale up production, more innovation needs to happen to create a competitive product. The price of production has been declining since its first costly creation in 2013. Improvements are still needed, however, to create a product that meets goals regarding taste and texture without becoming too expensive. It is an open question whether it can be scaled up to become market viable (Malila et al 2024, Treich 2021, Xie et al 2025)).

The motivations for creating cultivated meat are clear. With one stroke it might efficiently provide meat to a massive growing population, decrease animal agriculture's large environmental footprint, and alleviate many animal welfare concerns. Due to population and income increase, animal agriculture alone could use up half of the global Paris Treaty carbon budget by 2050 (Clark et al 2020). Animal agriculture contributes at least 14.5% of global anthropogenic greenhouse gas emissions, with cattle responsible for about two-

¹See the regulatory tracker at <https://gfi.org/resource/where-cultivated-meat-can-be-sold/>.

thirds of that total (UN FAO, 2016). Impacts on land use, biodiversity, water demand, and pollution are similarly devastating. There is a pressing need to reshape our food production. The question is whether cultivated meat represents an opportunity to help.

Because the technology is developing, it's hard to say. We can be reasonably confident of some impacts. It would be a major improvement in animal welfare. While some cultured meat relies on fetal bovine serum to grow animal cells, most companies are pursuing synthetic, plant, algae, or fermentation based serums. Land use and pollution benefits also seem fairly uncontroversial. The land required for cultivated meat production is dwarfed by the amount animal agriculture uses and there is no need for manure management. And of course there is no pollution from animal waste, need for antibiotics in animals, and so on. See Domingo et al 2021, Orsini et al 2026, Rodríguez Escobar et al 2021, and Smetana et al 2023.

Where there is less confidence is on its energy use and expected carbon emissions. The cultured media necessary to grow cells is biochemically complex and energy intensive to produce. The bioreactors are also energy demanding, as they must heat and stir the culture, which in turn demands cooling. The bulk of the energy comes from electricity, so as the grid becomes cleaner so does cultivated meat production. Importantly, the type of growth media, chemical processes, bioreactor design, and more are all actively being researched and designed. As a result, despite the great interest in forecasting the viability of cultivated meat as part of a solution to our environmental food crisis, there is substantial uncertainty in energy projections.

Despite posing only a hypothetical future threat to traditional animal agriculture, cultivated meat's mere existence has made it a wedge issue in a much larger ideological, cultural, and economic battle. Many areas have deep cultural and economic connections to animal production. To these areas cultivated meat represents not only a commercial threat but also a challenge to a certain way of life. Florida Commissioner of Agriculture Wilton Simpson provides a fairly typical reaction when he asserts that cultivated meat is "a disgraceful attempt to undermine our proud traditions and prosperity."² Hungary's petition to the EU for a ban mentions as one reason "the preservation of the traditional rural way of life."³

When one adds to this threat the above issues of climate change, broader environmental impacts, and animal welfare – which are already politically polarizing topics – the subject is easily coopted by much wider divides between urban and rural, red-state and blue-state, and traditional and technological camps. Right-wing social media claims that cultivated meat is, strictly speaking, cancer, which in addition causes "turbo cancer." The federal government is said to be feeding it to our military, using them as guinea pigs, and using your taxes to bail out struggling companies. In Florida, Rep. Dean Black, a cattle rancher, articulated his reason for a ban: "Cultured meat is not meat... [It] is made by man. Real meat is made by God Himself... If you want to try the nitrogen-base protein paste, go to California."⁴ Cultivated meat has become a wedge issue in a wider culture

²<https://www.popsoci.com/science/lab-grown-meat-ban/>

³<https://www.greenqueen.com.hk/eu-commission-hungary-lab-grown-meat-cultivated-ban-tris-notification>

⁴<https://x.com/FLVoiceNews/status/1765419999462629555>

war (Changing Markets 2024, Floor and Manlosa-Kirk 2025). On signing Florida’s ban, Governor DeSantis said, “Today, Florida is fighting back against the global elite’s plan to force the world to eat meat grown in a petri dish or bugs to achieve their authoritarian goals.”⁵

Despite its limited commercial availability, the sale of cultivated meat already has been banned in eight US states and Italy. Nineteen US states have labelling restrictions. More US states, the federal government, and EU nations have legislation pending or developing.⁶ These preemptive bans are ostensibly about food safety, yet they occur in the locations most economically and culturally connected to standard animal agriculture. In this context, a life-cycle assessment of cultivated meat’s climate impact is relevant not only to science but to the business, rhetoric, and politics of cultivated meat (Fino et al. 2024).

2 The Preprint

“I’d rather eat my shoe than lab-grown meat,” said the influencer Diana Rodgers, who then complained that “I have yet to see a life cycle assessment on the production of it” (Martinez 2023). Perhaps unbeknownst to her, life cycle assessments had been performed. Just two months prior to her remark one appeared that would achieve tremendous popularity. Risner et al 2023’s “Environmental Impacts of Cultured Meat: A Cradle-to-Gate Life Cycle Assessment” was posted April 21, 2023 on BioRxiv, the main preprint server for biology.

The preprint aims to find the climate impact of cultivated meat and compare it to that of standard animal agriculture. The emissions profiles of cultivated meat and animal agriculture are very different, so comparisons are tricky. For example, ruminants produce a lot of methane, soil management releases nitrous oxide, and deforestation eliminates carbon sinks, whereas cultivated meat draws most of its energy from the electric grid, whose carbon footprint varies with how this energy is sourced, processed, and transported. Both standard meat and cultivated meat estimates can vary tremendously. Cultivated meat forecasts depend on the assumptions mentioned above, such as type of culture media, bioreactor design; and meat estimates depend on kind of meat (e.g., beef, pork, chicken), farming practice, type of cut, and geography. Ideally a comparison would look at a full environmental profile across ranges of scenarios.

For coarse-grained comparisons, however, it’s convenient to find a single number as a proxy for impact. That number is CO_2 -equivalent produced per *kg* of meat. Because

⁵<https://www.flgov.com/eog/news/press/2024/governor-desantis-signs-legislation-keep-lab-grown-meat-out-florida>

⁶The state bans are Florida (Stat. § 500.452), Alabama (Code § 20-1-161), Mississippi (Code Ann. § 75-35-15), Indiana (Code § 15-17-5-6.1), Missouri (§ 50-31-511), Nebraska (Rev. Stat. § 81-2,282), Texas (Health & Safety Code § 431.02105), and Louisiana (Act 555 and Act 742). Italy’s ban is announced here: Gazzetta Ufficiale della Repubblica Italiana, 2023. The National Agriculture Law Center maintains a list of state actions against cultivated meat through Sept 5, 2025 at <https://nationalaglawcenter.org/state-compilations/alternative-protein-laws-state-compilation>. Federally in the US, various labelling acts have been proposed in both the House and Senate.

emissions on the animal side often are not from CO_2 , one translates non- CO_2 emissions (e.g., methane) into their CO_2 equivalents, CO_2e , and then determines how much CO_2e they each produce per kg of meat. While a deeper understanding is gained from unpacking these numbers, if the goal is simply to get a ballpark figure then these single numbers are convenient.

With these caveats, it is a robust finding that among animals, beef has by far the biggest climate impact, followed by pork and chicken. Plant proteins have an even smaller impact than pork and chicken. For beef the preprint uses the value of median $\sim 60 CO_2e/kg$. Where is cultivated meat? Estimates vary. See Table 1.

Tuomisto and Teixeira de Mattos 2011	1.89 – 2.24
Tuomisto et al 2014	2.27 – 4.38
Mattick et al 2014	3.15 – 22.28
Smetana et al 2015	23.90 – 24.64
Tuomisto et al 2022	4.88 – 25.19
Sinke et al 2023	2.82 – 24.80
Risner et al 2023	19.2 – 1508.00
Risner et al 2025	12.31 – 1508.3
Stieberová et al 2026	4.21–7.02

Table 1: Life Cycle Analyses in CO_2e/kg

The reader will note that two of these life cycle analyses are not like the others. Except for the two Risner et al studies, the 2023 preprint and 2025 published version, cultivated meat has vastly lower emissions than beef in all scenarios. The preprint, by contrast, offers an estimate for six scenarios, but emphasizes three using growth media purified to pharmaceutical-grade quality. These pharmaceutical-grade estimates are 4 to 25 times greater than the median global warming potential for beef, which is the range almost exclusively highlighted by the media. The largest figure — $1508CO_2e/kg$ — is roughly 60 times higher than the most pessimistic estimate from the previous six life cycle analyses, an extreme outlier. Any of the larger figures from the preprint would be devastating to the climate aspirations of cultivated meat.

As many immediately pointed out (Cellular Agriculture Europe, Crown 2023, Ólafsson 2023, Swartz and Olsen 2023), the preprint obtains this inflated carbon footprint by assuming that cultivated meat must use pharmaceutical-grade media. Because pharmaceutical-grade ingredients require very energy-intensive purification, that assumption drives up the emissions estimate by roughly $20\times$ that of food-grade ingredients. This assumption has struck many as unfair. Companies in this space never intended to scale up production with pharmaceutical-grade ingredients. They’ve known all along that it is too expensive and not necessary. Mosa Meat, for example, prominently claimed that they could use food-grade ingredients for 99.2% of its base cell feed in March 2023.⁷ It

⁷<https://www.foodnavigator.com/Article/2023/03/07/Mosa-Meat-Nutreco-replace-pharma-grade-ingredients-in-cell-feed-with-food-grade-alternatives/>

is true, as Risner et al assert, that then *current* production methods used predominantly pharmaceutical-grade media. Yet a *presupposition* of this technology scaling up is that the media switches to mostly food-grade. The conditional “If production continues to use pharmaceutical-grade media, what is its climate impact when scaled up?” is the wrong question to ask, for if production remains that way it will *never* be scaled up.

Another worry about the analysis is the estimation of the global warming potential (Swartz and Olsen 2023). The authors rely on Wernet et al 2010 for their assumption that pharmaceutical grade production has 25x the global warming potential of normal bulk chemical production. Wernet et al calculates the environmental impact of a single complex pharmaceutical compound, *not* the actual media used in cultivated meat production. Schwartz and Olsen question the relevance of that calculation. Even assuming it is relevant, however, they point out that the electricity mix is much cleaner now than in 2010.

That also makes a big difference. Wernet et al 2010 use the dataset from ecoinvent v2.2, which corresponds to Western Europe’s electricity mix across 2007-2010. However, the grid intensity in the EU is now half or less what it was in 2010. In California, it is about a third of 2010 values. Updating these values will make a large difference to the preprint’s purification estimates, and a small difference to their food-grade estimates. The reason for this difference is that the purification process is predominantly run from electricity whereas heating and some other processes are assumed to be based on natural gas or other fossil fuels. Werner et al base their energy demands on the 1997 Cumulative Energy Demand indicator. They write that CED is “a good indicator for chemical production in particular, as oil and gas are both the main energy source and the main material feedstock for chemical production.” A more generous analysis might replace some of this with heat pumps and electric boilers. Assuming a cleaner grid and electrifying some heat can cut the estimated CO_2e/kg substantially.

There are other questionable assumptions, but these two are enough to explain how the preprint finds a climate impact so at odds with previous analyses.⁸ To the outside observer, the preprint’s presentation seems somewhat skewed against cultivated meat. In addition to the above uncharitable assumptions, three other features attract attention.

First, the title describes the “environmental impacts” of cultivated meat, but the study focuses only on carbon emissions, ignoring cattle agriculture’s many other negative environmental impacts. Deforestation, air pollution, water pollution, aquifer depletion, soil degradation, and pesticide impacts are all ignored.

Second, the preprint’s final two paragraphs warn against governmental or private agents “allocating substantial research funding” or “capital” to cultivated meat until their environmental concerns are addressed. A direct call-out to possible future funders is atypical in a science paper.

⁸See Defendi-Cho 2025, which, in addition to questioning the assumption of using pharmaceutical-grade media, say Risner et al conflate “pharmaceutical chemical production” and Wernet et al’s “active pharmaceutical ingredients.” Fixing that would change the purification multiplier to 2-3 as opposed to 20, resulting in most scenarios doing better than beef even with the unrealistic pharmaceutical-grade assumption. On the specific choice of media, see also Swartz, Nahmias, and Tuomisto 2025 and Risner, Siegel, and Spang 2025.

Third, and most importantly, when the authors present their results, they write “The GWP for all ACBM scenarios (19.2 to 1,508 of CO_2e per kilogram of ACBM) was greater than the minimum reported GWP for retail beef (9.6 kg of CO_2e per kg of FBFMO) (Poore & Nemecek, 2018).” That summary switches from the *median* impact of beef, used throughout the paper, to the *minimum*. Their minimum value of 9.6 CO_2e/kg originates in Poore and Nemecek 2018. But that article does not perform a life cycle assessment. Instead it surveys 38,700 farms across 119 countries. The types of farms are massively diverse and we don’t know what 9.6 CO_2e/kg production looks like. Could such farms be scaled up to meet the demands of global beef agriculture? That is highly doubtful. Through studying 42 different practices, a recent study by Pelton et al 2024 finds the potential to reduce CO_2e by only 30%. In summarizing results, it seems odd to compare an unexplained and almost certainly unscalable beef scenario to cultivated meat today, especially when the authors resolutely reject modeling projected improvements in cultivated meat technology (“The main issue with these preexisting studies is that their technology models do not accurately reflect the current/near term practices ...”). Instead of a nuanced presentation in which cultivated meat does significantly better than beef in one scenario (19.2 vs 60 CO_2e/kg), the switch from median to minimum keeps the message uniformly negative towards cultivated meat.

This kind of framing is a type of hype. Later we’ll see how the press release amplifies it and how it makes its way into a legislative hearing in Australia.

It is not the purpose of this paper to pretend to know the truth about the climate impact of cultivated meat. No doubt it is substantial given the needs of the bioreactors. Disinformation is false or misleading information that is intentionally spread to advance one’s goals. Although the preprint may spin its conclusions in a manner unfavorable to cultivated meat and make questionable assumptions, I am not suggesting that the authors are intentionally spreading falsehoods. To my knowledge, there is no vested interest here.⁹ Funding for the research is listed as the United States National Science Foundation and the Innovation Institute of Food and Health at the University of California, Davis. The latter receives resources from industry, but not in a single pro-beef direction. What we do know is that the preprint’s life cycle assessment is a controversial outlier that hadn’t passed peer review, and moreover, that its conclusions are misleadingly framed. When this raw material enters a damaged epistemic ecosystem, misinformation will swamp the evidential landscape on this topic.

3 The Life Cycle Analysis’ Life Cycle

The preprint first attracted attention when *New Scientist* highlighted it on May 9, 2023 in an online article titled “Lab-grown meat could be 25 times worse for the climate than beef” (Klein 2023a), later republished May 13, 2023 as “Lab-grown meat’s dirty secret” (Klein 2023b). Both titles are based on the worst 25x scenario, as opposed to its less

⁹Defendi-Cho 2025 does wonder: “The lack of thoroughness, and the perhaps deliberate cherry-picking when selecting a single, poorly suited source to compare GWP of pharmaceutical-grade versus food-grade CCM components, call into question what interests Risner et al. (1) hope to serve.”



Figure 1: Screenshot of UC Davis Press Release

damaging ones, and refer to the product as “lab-grown,” a label disliked by the industry. The preprint is almost immediately picked up by some trade associations – presumably from *New Scientist* – whereby it quickly enters the culture wars. By May 17, 2023 it is highlighted by Donald Trump Jr, controversial commentator Tomi Lahren, and the *National Pulse* (Changing Markets 2024).

Then on May 22, 2023 UC Davis’ news office features it with the title “Lab-Grown Meat’s Carbon Footprint Potentially Worse Than Retail Beef” (Quinton 2023). See Figure 1. The message is muted slightly, as the title doesn’t refer to the worst case scenario, but the article inherits the skewed presentation of the preprint. After all, based on the same modeling, the press release might have been entitled “Lab-Grown Meat’s Carbon Footprint Potentially 68% Lower Than Retail Beef.” Three days later the University of California systemwide office repeats Davis’ release.

The press release contains many of the earmarks of hype (see Section 6). It doesn’t interview anyone outside two authors, nor does it mention any crucial research limitations. The release adds

investments to advance more climate-friendly beef production may yield greater reductions in emissions more quickly than investments in cultured meat

which is not substantiated by the preprint. Presumably this assertion is based on the preprint’s switching from the median to the minimum impact of beef, discussed above. Hype builds on hype.

The preprint then went viral. (Reasons for this will be discussed in the next section.) At the time of writing, its Altmetric Attention Score score was 2518, which was the 30th highest score for any preprint on BioRxiv (out of more than a quarter million).

It rose as high as the #8 read from *BioRxiv* and had a top 1% attention score among articles the same age. On social media platform *X* it was mentioned over 4200 times across 84 different countries, many from accounts with millions of followers.¹⁰ While this shows it had a vast audience, Altmetric data underestimates the preprint’s media penetration because it omits items that do not explicitly refer to the preprint. Many news articles, broadcasts, and other sources claim that cultivated meat has a carbon footprint of 25x that of beef agriculture and simply refer to the “UC Davis study” or reference the university press release instead.

To construct a more comprehensive picture of the preprint’s media coverage, data was compiled from three primary sources: Altmetric Explorer (Altmetric LLP), UniNexis (LexisNexis/Nexis Uni), and supplemental searches using Google News and ChatGPT using language-targeted queries (English, Spanish, Italian, German, and others). Search strings combined author names, institutional affiliation (“UC Davis”), key phrases (“lab-grown meat,” “cultivated meat,” “carbon footprint”), and variations of the press release headline. Items were included if they referenced the preprint, its findings, or the UC Davis press release. Non-news items (e.g., tweets, social media posts) were excluded. Items were manually checked to confirm reference. Duplicate detection used exact matching on (title, outlet, date) and normalized URLs, but aggregator republications (e.g., *MSN*, *Yahoo*) were retained as separate observations to help understand the preprint’s audience. The final master dataset, Supplemental Data, contains $N = 491$ distinct media items spanning May 2023–December 2025.¹¹

Through manual coding, items were identified as “nuanced” or not. Nuanced media items offered some uncertainty or methodological caveats or countervailing context about the UC Davis study (whether or not they were in favor of cultivated meat). Since the news items are swamped with rehashes (see Section 5) of the *New Scientist* article, preprint, press release, or subsequent syndication of these, I didn’t code in an independent manner because the outcome seemed overdetermined. On my scoring, only 6.5% of news items in *Supplemental Data* offered any nuanced discussion of the press release’s or preprint’s contents. The reader is welcome to score the items as they see fit.

Supplemental Data also shows that the number of *mainstream* or *legacy* media outlets reporting on the preprint shoots up dramatically just after the UC Davis press release. As readers can readily verify, either qualitatively or quantitatively (using their preferred categories), the reach and prestige of the outlets sharply increased after May 22, 2023 on any reasonable understanding of those terms. Prior to the press release, perhaps the only legacy outlets were the *Daily Mail*, a tabloid, and the *Irish Independent*, a center-right newspaper. The controversial talk show *The Five on Fox News* may have had the largest audience. After May 22, 2023, by contrast, one finds *CNN*, *BBC News*, *CBS News*, *MSN*, *Yahoo*, *Tagesschau*, *Der Standard*, *Bloomsburg*, *ABC News* (AUS), *Al Jazeera*, *Agence*

¹⁰<https://biorxiv.altmetric.com/details/146322496>

¹¹Supplemental Data can be accessed at DOI 10.5281/zenodo.22960679. December 2025 was chosen because the preprint was accepted for publication that month and published in January 2026. Limitations in this collection include the obvious ones, e.g., search term sensitivity, paywalls, but especially language bias and transcript availability. The latter leads to a likely large underrepresentation of broadcast coverage.

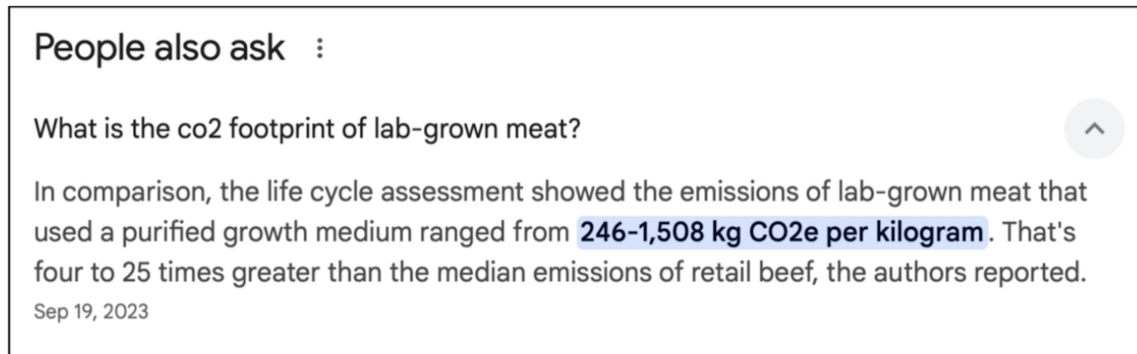


Figure 2: Screen Shot of (Google) Gemini’s Suggested Q&A, June 25, 2025

France-Presse, *Deutsche Welle*, *AOL*, *PBS*, *San Francisco Chronicle*, and *The Hill* all mentioning the preprint’s claims without nuance. Note that the news outlets after the press release spreads across the political spectrum.

In addition, *Changing Markets* commissioned Ripple Research to review over 285 million digital posts related to meat and dairy (Changing Markets 2024). The posts spanned a 14-month period from June 1, 2022 to July 31, 2023. Different analyses pick out different local peaks of climate misinformation. One peak in one analysis is May 23, 2023, and another is May 28, 2023, both attributed largely to the UC Davis press release. Furthermore, on the Altmetric timeline, one also sees May 23, 2023 as a local peak of attention, especially on X. See Fig [3]. Two independent looks at this time period confirm boosts just after the press release.

While correlation is not causation, we know the mechanism that would produce this effect. As discussed in Section 6, universities have relationships with science journalism platforms that widely and almost instantaneously produce the science news we see. In this case, the platform Science X, which claims to have a global reach of 10 million readers per month, bills itself as “a network of high-quality websites that provides the most complete and comprehensive daily coverage of science, technology, and medical news.” It vets articles before sharing them on their network. One of its partners is UC Davis. Phys.org, a web platform for institutional press releases and additional science news, is part of the Science X network. It published the press release, unaltered but for the picture, on the same day UC Davis does, May 22, 2023. Editor’s notes attached to the article tell us that Science X’s editors have reviewed the article and that “Editors have highlighted the following attributes while ensuring the content’s credibility: fact-checked, preprint, trusted source, and proofread.” Once plugged in to this platform, the preprint gets repackaged in various ways very quickly — often within a day — and goes into broad syndication, whereupon it picked up by public broadcasters and major broadsheets (e.g., *BBC News* June 1).

The evidence points very strongly to the university press release unleashing a cascade throughout mainstream media. With so much mainstream penetration, the preprint’s content saturated online discussion and thus the data on which AI assistants base their

Environmental impacts of cultured meat: A cradle-to-gate life cycle assessment

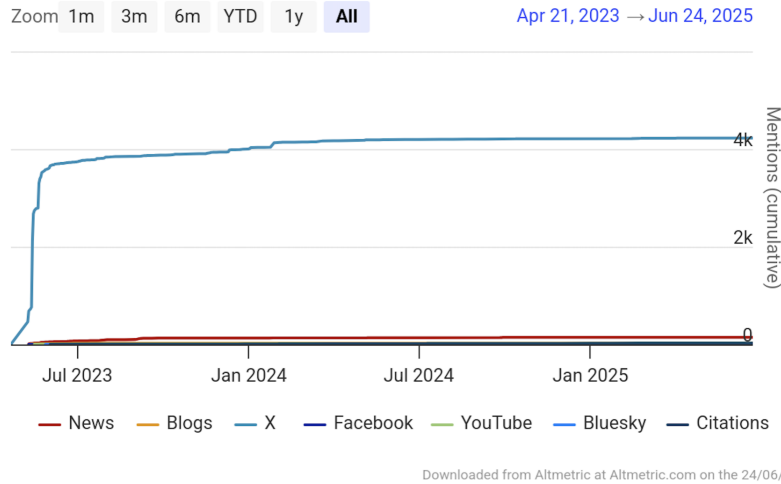


Figure 3: Altmetric timeline

answers. Figure 2 displays a suggested question and answer by Google’s Gemini two years after the preprint emerged. It’s hard to estimate the size of this impact, which, as we’ll later see, is almost irreversible.

In sum, UC Davis’ press office, like most other university press offices, possesses tremendous power. As a trusted source to science distributors, it can promote research in a way available to few others. In this case it chose to amplify research that hadn’t passed peer review presumably because its surprising claims would attract (or already was attracting) attention. This choice had serious consequences.

4 Societal Impact

The UC Davis release didn’t enter a “neutral” public media ecosystem. The polarization so prevalent in society around the environment, technology, and regulation already carved the landscape. Even before the study was done, Coldiretti, Italy’s massive agricultural association, launched a national campaign against cultivated meat. The label #NoCiboSintetico was widely used by Coldiretti chapters at community events and in petition drives. The organization claimed to gather 2 million signatures in support of a ban on cultivated meat. Elsewhere, there were already attacks on plant-based protein, and these could be quickly re-directed at cultivated meat. For example, in April 2023 the Center for the Environment & Welfare (CEW) was created. Its executive director, Jack Hubbard, is a partner of Berman and Co, a group infamous for supporting front groups

for the animal agriculture industry.¹² By December 2023 CEW began its campaign attacking cultivated meat. For instance, the website labmeat.com offered what looked like neutral advice, but its primary goal was to warn readers of the health and environmental impacts of cultivated meat. A whole page of information is based on Risner et al 2023.¹³

Trade organizations and lobbies for animal agriculture immediately seized the press release and preprint for their own purposes. Both were featured in these organizations' push for new policy, especially labelling regulations that prohibit calling the product "meat" and more ambitious laws that preemptively ban its production, sale, or purchase. For example, the Louisiana Farm Bureau, citing CEW, advocates for two bills that would ban cultivated meat, both of which became law.¹⁴ And in Australia, the Red Meat Advisory Council accused advocates of cultivated meat of greenwashing in the Australian Senate's Standing Committee on Environment and Communications inquiry into greenwashing, citing Risner et al 2023.¹⁵ In this case, they use it not merely to undermine the environmental credentials of cultivated meat, but to accuse environmental organizations of misleading others. See the many trade association and lobby publications in *Supplemental Data*.

Sometimes it's hard to separate the trade associations from the government. Italy's Prime Minister Giorgia Meloni signed on to Coldiretti's petition against cultivated meat and made it part of her party's platform. For Coldiretti, the preprint has been important: it features prominently in ten of their articles. Not one mentions or even hints at any concerns about the life cycle analysis. In a venture on sustainable meat (*Carni Sostenibili*) by three of Italy's meat organizations connected to the ban efforts, the preprint's estimate is even doubled — "Lab-grown meat can impact 50 times more than meat" — by comparing it to a "natural meat mix"!¹⁶

Lobbying plus media saturation has had an effect on policy. As mentioned, eight US states and Italy have banned the sale of cultivated meat, and many others are hoping to follow them. The status of both bans in Europe and the US is currently uncertain. Italy's ban may conflict with EU regulations and some US states' bans may violate federal commerce laws.

Connecting the breadcrumbs between Risner et al 2023 and actual policy is not always possible. A sponsor of Florida's ban, Rep Alvarez (FL), for example, claims, "But to believe that climate change or animal safety are the drivers behind this [cultivated meat], you would have to be absurdly uninformed." Presumably he is basing this claim about the climate impact from media originating in Risner et al 2023, but in public speech or even legislative discussion, citations are rarely made explicit. But they do sometimes

¹²Hubbard also writes articles hitting familiar tropes for newspapers, such as "Taxpayers Shouldn't Have to Bail Out Lab-Grown Meat Companies: Lab-Grown Meat is a Crony Capitalist Scheme Disguised as Environmental Progress" (Hubbard, 2024) <https://californiaglobe.com/fr/taxpayers-shouldnt-have-to-bail-out-lab-grown-meat-companies/>

¹³<https://labmeat.com/environmental-impact/>, accessed Feb 11, 2026

¹⁴<https://lafarmbureaunews.com/news/2026/3/2/louisiana-lawmakers-introduce-bills-targeting-lab-grown-meat>

¹⁵<https://www.aph.gov.au/DocumentStore.ashx?id=cdb31bfb-ec52-4dfd-a1cc-fbee0f217199&subId=744150>

¹⁶<https://www.carnisostenibili.it/en/lab-grown-meat-impacts-10-to-50-times-more-than-natural-meat/>

make an explicit appearance.

In Nebraska, Governor Jim Pillen — who owns hog and beef farms — made a crack-down on cultivated meat one of his signature initiatives. His Executive Order 24-09 states

“WHEREAS, current research suggests that Lab-Grown Meat’s environmental impact is significantly higher than naturally produced meat.”

and at the press conference announcing legislative candidate Jeanne Reigle — also a livestock producer — explained that “the energy it takes to run bioreactors producing such alternatives “probably” far outweighs gas emissions in traditional ag,” (Wendling 2024). Neither explicitly cite Risner et al 2023, but the preprint’s claims were definitely in the air in Nebraska. In testimony before Nebraska Legislature’s Agriculture Committee, Department of Agriculture Director Sherry Vinton — a cattle rancher — testified in favor of the ban. Twice she mentions UC Davis’ preprint:

The companies also claim their bioreactor meat will be more humane and environmentally-friendly product than conventionally-raised livestock. However, a 2023 preprint report from UC Davis found lab-grown meat to have a much higher carbon footprint than U.S. raised beef.

Later, asked to expand on the carbon footprint of cultivated meat, she answers:

That’s another thing. There hasn’t been a full lifecycle analysis on this, so they haven’t done the, the full lifecycle analysis on the cell-based meat or the cultured protein food, as far as the energy uses that it’ll take, for example, for the bioreactors and on the different growth mediums that they’ll be using. And UC Davis has a food center there, and they’ve actually done some research on this, and they’ve found that conventionally-raised beef in Nebraska specifically would have, perhaps, a carbon footprint that would be anywhere from 4 to 25 times less than this.

In Europe the delegations of Austria, France, and Italy issued a joint to the EU expressing profound concern about cultivated meat (General Secretariat of the Council 2024).¹⁷ In this document they directly appeal to Risner et al 2023, claiming that “[i]nitial studies also show a poor climate balance of lab-grown meat and indicate a very energy-intensive process, generating up to 25 times more CO2 equivalent per kilogram of meat produced compared to genuine meat.”

And in Australia Senator Malcolm Roberts spoke on the floor of Parliament to say that the “University of California Davis” has “found the environmental footprint of these Frankenfoods is worse than that of naturally grown pasture raised beef.”¹⁸

The preprint that had not been peer-reviewed and university press release were used internationally to shape public policy and influence the fate of a potentially valuable protein alternative.

¹⁷<https://data.consilium.europa.eu/doc/document/ST-5469-2024-REV-1/en/pdf>

¹⁸https://www.aph.gov.au/Parliamentary_Business/Hansard/Hansard_Display?bid=chamber/hansards/28689/&sid=0277

5 Churnalism: The Power of a Press Release

How do university press releases manage to have such influence? To briefly answer this – and highlight the power they have – we need to explain “churnalism” and its rise.

Journalism, and especially science journalism, has suffered major job losses and funding cuts in the past few decades, resulting in fewer journalists, fewer science specialists, and each one writing more copy (Joseph 2018, Schafer 2017). The result is less time to do “adequate” checks on the facts (Williams 2015, 156). Meanwhile, universities, suffering public funding cuts of their own, must increasingly compete against others for attention and public and private money. Universities have found that press releases are one of the best ways to attract attention to their research (Autzen 2014, Entradas and Bauer 2022). In a large longitudinal study in Switzerland, for example, researchers found that both the influence and effectiveness of university media releases has increased over time (Vogler and Schafer 2020).

In addition to universities and journalists, an additional player is crucial to this ecosystem: research news aggregators and distributors, such as EurekaAlerts, Newswise, and Science X. These platforms often have agreements with universities to more or less publish their press releases. We saw this with the UC Davis preprint and Science X. Science X doesn’t provide peer review or any meaningful content analysis, but it does add a filter: it trusts research promoted by universities and other respected entities. EurekaAlerts, run by the AAAS, emphasizes peer review, but it will also distribute information from sources it deems credible. Science X but not EurekaAlerts highlighted the UC Davis study.

These trends in journalism and academia mixed with the existence of these media platforms results in “churnalism” (Davies 2008). Churnalism is the practice of essentially cutting and pasting news releases and turning them into articles. Textual analyses have been done that show that very little changes as text goes from a university press release to a published article. That is certainly the case with the UC Davis study, as readers can find the news release reprinted, more or less intact, as an article in scores of outlets. See Supplementary Data.

The influence is hard to overestimate. One study in South Africa found that *half* of science media articles there had at least a 50% textual similarity to press releases originating from only four South African universities (Heyl et al 2020). The above study by Vogler and Schafer 2020 discovered that 42.7% of science newspaper articles originate in university press releases. Comfort et al 2024 found that up to 65% of news article sentences had high similarity to press releases from universities and think tanks. A staggering amount of science journalism originates — and is repeated virtually untouched — from university press releases.¹⁹

Universities and journalism solve each other’s problems — or more negatively put, exploit each other’s vulnerabilities. Overworked and non-specialist journalists cannot fact check or analyze research the way they previously could and must produce more

¹⁹As O’Connor and Weatherall 2020 show, just a few influencers can have disproportionate effects throughout a knowledge network. Churnalism is a powerful mechanism for obtaining this amplification.

and more content. Universities, meanwhile, are desperate to enhance their reputation and highlight research to attract funding and applications. Distribution platforms are the bridge between the two that provides a convenient solution. To journalists it offers a steady supply of minimally vetted science news already written in an accessible fashion by a trusted source. To universities it offers access to a wide audience and the ability to curate for themselves the research that is seen by the public.

6 “Irreversible” Hype and Disinformation

Large universities produce mountains of research each year. How do their press offices select what to highlight? Rehashing university press releases might be harmless if these offices pick research based on academic significance, rigor, and accuracy. That is hardly the case, however, for they “too frequently do so in ways that prioritize web traffic over accuracy” (West and Bergstrom 2021) and “are written for the express purpose of making the institution look good (Heyl et al 2020, 131). The public is essentially getting a substantial amount of its media about research from the public relations wing of the university.

This output is subject to systematic hype. Hype can originate from the original researchers or the press officers or both (on hype in general, see Intemann 2020; on its sources, King 2019, Sumner et al. 2014, 2016). The hype commonly states or hints that an association between variables is causal, even if the study only provides evidence of an association. Or hype might omit or downplay crucial limitations, as was done in the UC Davis press release. This type of outcome appears to be common. In a study of how the topic of ocean plastics is reported, Vonk et al 2024 find heavy overlap in 495 articles based on 84 press releases. As they note, research limitations were scarcely mentioned. Hype can also add claims that aren’t supported by the research, as we saw performed by both the scientists and press officers in our case study. Both claimed future investments in beef would do better for the climate than improvements in cultivated meat technology, yet that was asserted without evidence.

Hyped claims can find their way into policy debates. For example, in debate in the Parliament of Western Australia, Jackie Jarvis, the Minister for Agriculture and Food, refers on September 18, 2025 explicitly to the UC Davis press release (not preprint) and read aloud highlighted pieces, including

suggesting that investments to advance more climate-friendly beef production may yield greater reductions in emissions more quickly than investments in cultured meat.²⁰

As discussed, this statement was not substantiated in the preprint. Yet it is being read in a national parliamentary body to undermine cultivated meat’s climate aspirations and to shape policy. Google searches of this sentence find it being used in many news reports. The press officer, by deciding to write this hyped claim, in effect had a direct line to the halls of a parliament.

²⁰<https://www.parliament.wa.gov.au/hansard/daily/uh/2025-09-18/8>

Things can get worse. Heyl et al warn, “There would be even more reason for concern if press releases from science-related industry organizations were re-published in a similar, uncritical fashion” (131). As research in disinformation has shown, industry can “capture” or strongly influence areas of the academy. Industries such as fossil fuel, big data, chemical, and agriculture pour hundreds of millions of dollars into research in universities across the globe (Hiltner et al 2024, Legg et al 2021, Michaels 2019, Oreskes and Conway 2010). Often this is not disclosed in press releases, as seen in the above ocean plastic study (and below). Even when funding is disclosed, universities can become a seemingly independent mouthpiece for industry-favorable news, and more generally, falsehoods.

Indeed, one needn’t look far for examples. Morris and Jacquet 2024 show that the CLEAR Center at UC Davis is hard to distinguish in aims from the beef industry that supplies most of its funding (see also Boren 2022, Tabuchi 2022, and more generally, Stănescu 2020). They write that UC Davis is “enabling” the beef industry “to engage in substantial public relations efforts” and lending its university name “to lend credibility to those activities.” One way the university helps industry is by issuing press releases. CLEAR directly puts out dozens of releases, but UC Davis itself issues many releases featuring CLEAR and its founding director, Frank Mitloehner. UC Davis profiled Mitloehner’s work in a piece titled “Don’t Blame Cows for Climate Change” (Wright 2009), which notes Mitloehner’s funding from beef. However, the 2019 release “Cows and Climate Change” (Quinton 2019), which argues that “cows as part of the climate change solution,” by contrast, doesn’t mention it. If CLEAR is effectively an arm of the beef industry’s disinformation campaign, then the university has used its position to legitimize and spread disinformation.

An additional problem is worth stressing: once the press release is out, there is no turning back. Many studies have shown that the impact of an article is stubbornly resistant to retraction, that retracted studies in fact average more citations than non-retracted ones (e.g., Schmidt 2024). Here we face a kind of counterpart. The preprint is eventually published in *ACS Food Science & Technology*, online Dec 29, 2024 and with an official date of Jan 17, 2025. The published version still contains the core two debatable assumptions mentioned earlier, but it also modifies the analysis in ways that make it less damaging to cultivated meat. The new numbers without purification go down to $12.3 - 75.4 \text{ CO}_2\text{e/kg}$, where 12.3 represents an 80% drop in emissions from beef’s median of $60 \text{ CO}_2\text{e/kg}$. Two of the three unpurified scenarios are less than the impact of median beef, and one purified scenario is roughly comparable ($75.4 \text{ CO}_2\text{e/kg}$). So three of the six scenarios report improvements or little difference.

The differences between the preprint and peer reviewed article vanish into the ether. Again using Altmetric (6/23/2025), the peer-reviewed piece gets 2 news outlet mentions, whereas the preprint gets 129 news outlet mentions. In time the published version may pick up more, but it is now old news. The published study will never receive the wide attention of the preprint. The university will not put out a new press release on the old one, nor will history repeat the above debate in Western Australia’s Parliament or the many Google searches landing on the release. See Dumas-Mallet 2017 et al. You can’t undo a press release.

Kaurov and Oreskes 2025 trace the influence of an article on the chemical glyphosate

long after it was exposed as “ghost-authored” by the company Monsanto. After being discredited, the paper nonetheless had a shockingly long “afterlife” on *Wikipedia* and elsewhere. In the present case we see how the “pre-natal” life can be surprisingly influential. In fact it is vastly more influential than the published version.

The uncritical rehashing of university press releases wouldn’t be a problem if university press offices had the means and goals of being a watchdog for the public’s interest. But they are after reputation enhancement, and worse, some of the research reported is hyped and biased by (often undisclosed) vested interests. With few filters apart from reputation enhancement, they can be a conduit to hype and disinformation, and thanks to churnalism, they can provide the fuel that powers disinformation campaigns.

7 Epistemically Polluted Ecosystems and the Social Responsibility of a University

Our case study reveals what I would like to call an *epistemically polluted ecosystem*. Instead of one vested power pulling the strings to spread disinformation favorable to its interests, here we have many smaller actors each with their own particular interest in slightly misleading information. The study’s authors both in the preprint and in interviews for the press release add hype to increase attention to their work, the university wants to curate its image to better place itself in a competitive market, so it adds additional hype and charges its press office with attracting clicks, journalists need cheap accessible copy that doesn’t require fact-checking or subject expertise, science distribution networks need reliable partners that don’t demand resources, and the public contains a polarized society filled with coordinated disinformation campaigns. The information ecosystem is polluted. Even without an obvious agent manipulating all these levers to produce a desirable outcome, we still wind up with same outcome: a society where misinformation helps shape public policy.²¹

Although responsibility is distributed in this case, that doesn’t mean it vanishes. One could write separate articles about the responsibility associated with each agent in this network, but here I want to concentrate on the role of universities.

The problem of universities amplifying misleading or unvetted claims is an especially serious one because universities occupy a special role in society. Enabling disinformation is contrary to the very mission of a university. Academia, like journalism, is a knowledge institution crucial to a flourishing deliberative democracy. In a deliberative democracy the goal is not merely the satisfaction of preferences but of well-informed preferences. Democracy, on this view, is not simply about aggregation of actual preferences. Central to the democratic ideal is the exchange of arguments, information, and reasons (Cohen 1989, Lynch 2018, Susstein 1997). Good deliberators will understand each other’s arguments and see reasons behind their opponents’ views. We want the public to believe the right things for the right reasons. The university is part of what Irzik and Kurtul-

²¹Of course the contrast with a single vested interest like the tobacco industry is one of degree, not kind, as tobacco, fossil fuel, agrochemical industries and the like can also take advantage of these diverse interests.

mus 2021 call the “basic epistemic structure” of a democratic society, with a duty to provide “the knowledge necessary for effective democratic governance.” Ultimately, it is this important role they play — creating an educated citizenry, generating knowledge, providing expertise for developing good policy — that justifies their special standing in society. For these reasons and more misinformation is widely viewed as a threat to deliberative democracy (McKay and Tenove 2020).

To put the violation of the university’s mission plainly, notice that an epistemically responsible inquirer could easily come away with the belief that cultivated meat is worse for the environment than beef agriculture. Few are experts. We can’t expect the public to do extensive fact-checking. A person who viewed mainstream local television and newspapers, and even double-checked with a Google search, would have relied on a reasonably acceptable epistemic network. Despite this due diligence, they would likely develop a very misleading set of beliefs. And that is because the university, contrary to their mission, helped pollute the informational ecosystem.

How big of a problem is this? That is an open question. Woloshin et al 2009 found 12% of university press releases were based on unpublished conference proceedings. That study, however, only looked at EurekaAlerts, which applies vetting, and one particular field. Nonetheless, qualitative searches of any major research university’s media page quickly reveals the problem. Highlighting work that hasn’t passed peer-review or that adds hype or doesn’t disclose funding is very common.

Moore 2006 asks, when bad science is in the headlines, who will take responsibility? While universities may not intentionally spread disinformation, we know that they have practices vulnerable to the spread of hype and disinformation. Being a knowing conduit of misinformation and disinformation is an abrogation of their duty and contrary to their mission in society. Instead of providing expert advice to the public so it can make good policy, it is often undermining this goal. While it may be impossible to eliminate the problem given the wider societal pressures, they nonetheless have a responsibility to address it.

8 Fortifying University Press Releases Against Disinformation

What can universities do? Universities have a long history of “externalizing” their ethical and social responsibilities. In the US, for example, the existence of internal review boards and conflict-of-interest offices were both imposed by demands from external federal funding agencies. After waves of scandals involving pharmaceutical funding and gifts to medical researchers, many academic journals imposed strict disclosure and conflict of interest policies. So one can imagine an externally imposed reaction to this problem.

Indeed, the (in)famous “Ingelfinger Rule” is one. Named after Franz Ingelfinger, the editor of *The New England Journal of Medicine*, the rule forbids publication in the journal if a study’s results are made public before publication. How this rule has been implemented varies tremendously, from ruling out preprints to the release of data. Relevant to us is that some versions prohibit the publication of any paper whose results have previ-

ously been announced in a press conference or release. The Ingelfinger Rule is massively controversial, as critics point out that many of its aspects fly in the face of the open science movement and were designed to maximize a journal’s control of the news. Most journals do not adhere to it now.

In any case, an “in-house” solution is preferable. Universities have a mission-derived duty to fix the problem. *New Scientist* is a for-profit magazine that routinely hypes work that hasn’t been peer-reviewed. They operate in a competitive market and its writers face pressure to get newsworthy items out first. As non-profit knowledge institutions that support democracy, universities should not get in this game. Their goal should be educating the public by providing high-quality, significant information vetted by expert consensus. They have tremendous power and need to exercise it responsibly.

Universities therefore need to impose filters on what they choose to highlight in the press and how they do so. To start, universities should impose a policy that restricts press offices from promoting research that hasn’t passed expert peer review. One can contemplate allowing some exceptions²², but in the vast majority of cases the main reason research is highlighted before peer review is that the university wants to be early on the scene and not have the story scooped by others. In other words, the university is functioning like a for-profit entity in a market, not like a responsible knowledge institution in a democracy. Stewart 2003 argues for a similar policy over the entire media, for-profit and non-profit, but the case is especially compelling in the case of knowledge institutions, who receive many benefits from the public in return for the role they play in a democracy.

We know such a policy can be enacted because it already has been at the University of Maryland. On December 22, 2015 the University issued a press release saying that a particular brand of chocolate milk, Fifth Quarter Fresh, would help student athletes recover from concussions. The study had not been peer-reviewed, and the author had significant conflicts of interest in the work. The scandal triggered an internal investigation, where one recommendation was that the university press office not highlight work that hasn’t survived peer review.²³

In addition to such a prohibition, university press offices could other practices mandatory, such as always disclosing the research’s funding source, mentioning limitations of the research, interviewing academics not involved in the study, and so on. They could also train and review their press officers in an effort to build a culture of responsible reporting.

Of course, surviving peer review is no universal panacea. Paper mills exist, journals get captured by vested interests, referee quality is spotty and itself can be biased, and much more (see Heesen and Kofi Bright 2021). Training press offices in best practices also will additionally only go so far. Disinformation will slip through this policy. Even science that is impeccably reviewed can turn out to be wrong. That the policy is not perfect, however, is no reason to not implement it. In cases where it failed to filter poor

²²One might carve out exceptions for when “fast science” (Stegenga 2025) may be needed in public emergencies. As we know from COVID, where public policy was often affected by science by press release, that is a controversial topic (see, e.g., Fleerackers et al 2021). It needn’t be decided here .

²³https://web.archive.org/web/20160418111821id_/http://umdrightnow.umd.edu:80/sites/umdrightnow.umd.edu/files/16-03-24-report-final.pdf

studies, an in-house solution would at the very least allow the university to claim it acts in a socially responsible way.

Suppose UC Davis had adopted this policy. How might things have gone differently? It's impossible to say for sure, but we can make some reasonable guesses. The press release would not have happened until acceptance in December 2024, not May 2023. In that span of time both the scientific content of the paper and features of the outside world changed. The university news office would now see that *half* of the scenarios in the study could not be spun as having a much worse impact than beef. Public responses to the preprint appeared on BioRxiv. So did additional studies that disagreed with Risner et al's modeling assumptions (e.g., Wali et al 2024). Companies made public announcements of developments in non-pharmaceutical-grade growth media. Again, the counterfactual is impossible to determine, but perhaps it's not unreasonable to suggest that had the press office waited until December 2024 then its release may have better reflected expert consensus than the actual release in May 2023. Or perhaps it may not have issued a press release at all, thereby avoiding the cascade into mainstream media altogether.

9 Conclusion

In cybersecurity one tries to reduce the risk of exploitation through known vulnerabilities. This practice is called *vulnerability mitigation*. Applying a software security patch to cover a known system weakness is an example. This paper has shown that a type of vulnerability mitigation is needed at universities if they are to fulfill their mission. Due to the nature of the science media ecosystem, university press offices have inordinate power to shape the public perception of science and therefore also policy. Our case study shows how research that had not yet passed peer review was hyped by the university and thanks to churnalism subsequently spread to the mainstream media. In some quarters the hype was transformed into disinformation used to fuel ideological battles and help pass laws against an emerging and potentially beneficial technology. Because universities have a mission to provide sound advice to the public, they have a social responsibility to "patch" this vulnerability.

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