Colossal Disinformation

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Positionality statement

I have a position: de-extinction is *almost* impossible, however, deëxtinction, a word invented by the world's first "de-extinction" company Colossal Laboratories & Bioscience's can be (Max 2025); hereafter Colossal, which they define as the creation of genetically modified organisms (GMOs) that appear and act like extinct species, is possible. It's branding, not science. I and other critics of Colossal have been subjects of a "dark public relations" campaign to discredit us (Wolinsky et al. 2025). Here I briefly explore how deëxtinction distorts basic genetic principles, species concepts, and ultimately undermines public trust in science. My critique is not of synthetic biology or GMOs. In this essay "I settle the matter once and for all, by showing which elements of each side are correct" (Clarke 2012). Only one side is correct, and it's not the one advertising deëxtinction.

Introduction

"We need not marvel at extinction; if we must marvel, let it be at our presumption in imagining for a moment that we understand the many complex contingencies, on which the existence of each species depends." — Charles Darwin, Chapter X (*On Extinction*), of *On The Origin of Species*

Nearly all species that have ever been, or will be, have gone, and will go, extinct (Raup 1986). Extinction is normal, not a reversible aberration. Alleles, genes, populations, species, ecological niches, and entire ecosystems will go extinct. Once thought impossible, the reality of extinction was discovered by the great French naturalist Georges Cuvier, whose *Essay on the Theory of the Earth* (1813) proposed the theory of catastrophism: that Earth's history was punctuated by rapid, and unpredictable, episodes of sudden of violent upheaval (Cuvier 2009). Drawing from extensive fossil evidence, Cuvier demonstrated both the truth of extinction and the successive replacement of organisms through time. What other than extinction could explain the nearly simultaneous disappearance of entire species from the fossil record, such as the woolly mammoth (Gould 2002; Amundson 2005; Weiss and Dunsworth 2014).

Even if possible, extinction was almost always inferred from the fossil record rather than directly observed; validating Cuvier's view that catastrophes and extinctions were extremely

rare; although the “Big Five” and maybe now six extinctions in earth's history may posthumously prove him correct. Only a small number of cases were directly observed, such as the extinction of the dodo on Mauritius and its close relative, the Rodrigues solitaire, on Rodrigues Island (Fuller 1988; Fuller 2002; Cheke and Hume 2008).

Unlike the global upheavals envisioned by Cuvier, these extinctions were slow moving catastrophes, the result of human activities ultimately foreshadowing the coming of the Anthropocene mass extinction (Wake and Vredenburg 2008; Ceballos et al. 2017). Ironically, the rise of the dodo from fantasy to fame was immortalized by its extinction (Turvey and Cheke 2008). Even our understanding of the dodo, which was once thought to be silly looking, dumb, and inept, has been transformed into one that was fast, agile, and behaviorally active (Timperley 2025 July 15). Which version will Colossal Deëextinct? V1 or 2?

As Darwin noted, extinction isn't marvelous, it’s the cost of life, and, as shown by Cuvier, forever. That was until Colossal made an astonishing false claim: they brought the dire wolf (*Aenocyon dirus*) back from extinction (Colossal Biosciences® [@colossal] 2025; WIRE 2025 Apr 7). This claim was breathlessly accompanied by deadlines in *Time Magazine* (Kluger 2025 Apr 7) and The New Yorker (Max 2025 Apr 7). And they promise to deëxtinct other species too, including woolly mammoths *(Mammuthus primigenius*), Tasmanian tigers (*Thylacinus cynocephalus*), the dodo, the moa (*Dinornis novaezealandiae*), and, most recently, the bluebuck antelope (*Hippotragus leucophaeus*) (Bluebuck 2026 Apr 30).

Why? According to Colossal co-founder and CEO Ben Lamm "It's unethical not to do this. It's immoral not to do this.” (Stein 2026 Mar 4). Claims of de-extinction/deëxtinction raise important conceptual, ethical, and biological questions (Odenbaugh 2023; Hoffman et al. 2026). What does it mean to de-extinct or deëxtinct an extinct species? And to what extent can the tools of genome editing and synthetic biology meaningfully reconstruct organisms. Is there a moral hazard to deëxtinction (Lean et al. 2026)? In this essay I explore only a few aspects of these complex questions.

What Actual De-extinction Requires

It is possible to bring a species back from extinction, but only under *very* specific circumstances. The world's first de-extinction was the Pyrenean ibex (*Capra pyrenaica pyrenaica*), one of four subspecies of the Iberian ibex (*Capra pyrenaica*) that inhabited the Cantabrian Mountains and the Pyrenees of northern Spain and the extreme south of France (Pérez et al. 2002). Once locally abundant, the causes of their extinction are sadly too common: a combination of overhunting, competition with non-native species, and habitat destruction (Searle 2022). The last Pyrenean ibex, a female named Celia, was found dead on 6 January 2000; before her death, cell lines were established from skin biopsies, preserving at least a part of her and her heritage. These cells were fused to enucleated mature oocytes collected from

domestic goats. Of 439 embryos only one gestated to term and was delivered by caesarean section; sadly that clone died a few minutes after birth — the Pyrenean ibex has the distinction of being the first species to go extinct twice (Folch et al. 2009; Searle 2022). But even if it survived it would still be functionally extinct because there was no male for these females to breed with.

A related approach is being used in an attempt to resuscitate the functionally extinct Northern white rhinoceros, of which there are only two surviving individuals, both female (Zywitza et al. 2022). In this case, intracytoplasmic sperm injection (ICSI) of cryogenically preserved Northern rhino sperm into cryogenically preserved Northern rhino eggs, followed by surrogacy in Southern white rhinoceroses (www.BioRescue.org).

These technologies are remarkable methods of conservation biology because they preserve the genuine hereditary continuity with the extinct or endangered lineage. They do not reconstruct species by approximation, or the sideways introduction of a few genes from an extinct species into a living lone; they extend existing biological inheritance forward through time using preserved cellular material from the organisms themselves.

Colossal's Rebranding of GMOs

According to Colossal Biosciences's press release (Colossal Biosciences® [@colossal] 2025; WIRE 2025 Apr 7), no paper describing their methods is available, requiring us to assess the technical basis of their work from strategically framed press releases. We are told the process began with non-invasive isolation of endothelial cells from peripheral blood draws of gray wolves one of the closest living relatives to dire wolves (Gedman et al. 2025), or not, *cf.* (Gopalakrishnan et al. 2018; Perri et al. 2021); while the press release and their public relations representatives describe this method as novel, it has already been developed for other mammals (Asahara et al. 1997; Boyer et al. 2000). These cells were reportedly expanded in culture followed by, "Performed multiplex gene editing to a donor genome from their closest living relative, the gray wolf, resulting in edits 20 sites in 14 genes with 15 of those edits being extinct variants. They inferred that the dire wolf genome had "protein-coding substitutions in three essential pigmentation genes: *OCA2*, *SLC45A2*, and *MITF*, which directly impact the function and development of melanocytes. While these variants would have led to a light coat in dire wolves, variation in these genes in gray wolves can lead to deafness and blindness. The team therefore engineered a light colored coat in Colossal's dire wolves via a path known to be safe in gray wolves: by inducing loss-of-function to *MC1R* and *MFSD12*. These genes influence expression of pigments eumelanin (black) and pheomelanin (red) in melanocytes that deposit to the coat, achieving the lighter pigmented coat color phenotype suggested by the dire wolf genome but without any potential health impacts." They apparently painted their GMOs white, perhaps to evoke the dire wolf *Ghost* from *Game of Thrones*.

Following genome editing, grey wolf nuclei carrying the modified genomes were transferred into enucleated dog eggs using somatic cell nuclear transfer (SCNT); perhaps using methods similar to previously developed to generate transgenic dogs using CRISPR-Cas9 genome-editing (Kim et al. 2022) and SCNT (Lee et al. 2005; Nagashima et al. 2015). It has been reported that 45 early stage embryos were implanted into eight surrogate dogs, of those 360 embryos, two males and a female were gestated to term and born by caesarean section (McKenzie 2025; WIRE 2025 Apr 7). While each step in this process draws on established cloning and genome editing techniques, without independent genome sequencing data, these claims cannot be independently verified.

Despite these incredibly minor genetic tweaks — 20 mutations out of nearly 2.5 billion nucleotides affecting only 15 out of 30,722 genes — Colossal declared they had resurrected the dire wolf, or 0.0000008% of one anyway. Following Colossal's argument that 20 mutations transmutates gray wolves into dire wolves, every human that ever was or will be is a different species from each other because we differ by about 6 million mutations, including parents and their children, who differ from each other by, on average, around 150 mutations (Porubsky et al. 2025), which is obviously absurd.

What does it mean to be a Colossal species?

Colossal's claim to "de-extinction" exploits a longstanding, challenging, and ongoing debate over what it means to be a species; and if they even exist as unique taxonomic units, how to define them that has lasted thousands of years. In one of the earliest attempts to define what it means to be human, Plato described us as featherless bipeds. Seeing the absurdity of this definition, Diogenes the Cynic gave Plato a plucked chicken and exclaimed, "Behold! I've brought you a man." In response to Diogenes's challenge, Plato's followers amended their species definition to include the clause "with broad, flat nails," transforming it into "a featherless biped with broad, flat nails." While this story is likely apocryphal, Colossal's "morphological" and "functional" (morphofunctional) species concepts is just as problematic.

There are up to 27 species concepts (Wilkins 2011), all grounded in more than a century of evolutionary theory supported by sound empirical data. Instead of using any of these definitions, Colossal invented their own, that conveniently reframes the common-sense definition of "de-extinction" as reversing extinction. Thus, de-extinction becomes "deëxtinction" (Max 2025) or "functional de-extinction," which are GMOs that look like and act like extinction ones (Colossal 2021 Aug 16).

Colossal's morphofunctional species concept, that if organisms look and act like another they are the same species, ironically fails the duck test: if it looks like a duck, swims like a duck, and quacks like a duck, then it probably *is* a duck even if it has a few mutations from a dodo. Such transmutation of species hasn't been taken seriously since Linnaeus;

hopeful monsters excluded (Theissen 2006). Such phenetic species concepts, i.e., classifying organisms by overall similarity in form and function rather than by their evolutionary history, hasn't been taken seriously since Hennig (1950).

Brands and Labels

In a remarkable bit of lawfare, Colossal has filed patents and word marks to protect its "brand identity" and legalize the definition of de-extinction as the introduction of a single gene sequence from an extinct species into a living one, even if that gene sequence differs from a living species by a single mutation (Regalado 2025). According to their definition, Colossal has not achieved the world's first de-extinction, that honor goes to Agata et al., who generated transgenic mice with a Neanderthal/Denisovan variant in the transcription factor GLI3 (GLI3 R1537C); this single mutation affected skeletal morphology, suggesting that this extinct hominin variant contributed to species-specific anatomical differences between archaic and anatomically modern humans (Agata et al. 2023).

Does a single mutation transform mice into archaic humans? Does a single mutation transform Asian elephants into woolly mammoths and gray wolves into dire wolves? According to Colossal's patent they do. At least until the patents expire, and they revert back to their original forms, becoming transgenic gray wolves and Asian elephants again. Sadly, this species definition has legal precedent. On January 3, 2003, the United States Court of International Trade ruled that the fictional X-Men weren't human because they don't resemble humans — a single mutation legally transforms living species into extinct ones, humans into "mutants" (Barzilay 2003; Sriskandarajah 2011; Grimsted et al. 2024).

What is to be done?

Colossal's disinformation about their ability to bring species back from extinction, advanced by press releases and glossy access journalism that lacks outside expertise, will further erode trust in science, scientists, and the institutions that support them. Their impossible claims about de-extincting an evergrowing menagerie of species: dire wolves, woolly mammoths, Tasmanian tigers, the dodo, the moa, and, most recently, the bluebuck (Bluebuck 2026 Apr 30), has already had dangerous consequences.

The Secretary of the Interior heralded in an X post that with the revival of the dire wolf it's "time to fundamentally change how we think about species conservation," that "the marvel of "de-extinction" technology can help forge a future where populations are never at risk," and that "The Endangered Species Act [ESA] has become like the Hotel California: once a species enters, they never leave; 97 percent of species that are added to the endangered list remain there." (Secretary Doug Burgum [@SecretaryBurgum] 2025). Obscuring the obvious fact that 97 percent of species remain on the list because we have failed to protect their habitats from

human encroachment, we cannot remove them from the list because we have failed to protect them. Colossal will not bring any species back from extinction, they'll just make GMOs. It is our responsibility to counter the weaponization and the spread of disinformation. If it's not us, then who?

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