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The Opposite of Human Enhancement: Nanotechnology and the Blind Chicken Problem

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Abstract Nanotechnologies that have been linked to the possibility of enhancing cognitive capabilities of human beings might also be deployed to reduce or eliminate such capabilities in non-human vertebrate animals. A surprisingly large literature on the ethics of such disenhancement has been developed in response to the suggestion that it would be an ethically defensible response to animal suffering both in medical experimentation and in industrial livestock production. However, review of this literature illustrates the difficulty of formulating a coherent ethical debate. Well structured arguments for disenhancement can be made on the basis of mainstream views on the basis of ethical obligations to animals, but these arguments have not been persuasive against the moral intuition that disenhancements are unethical. At the same time, attempts to ground these intuitions in a coherent philosophical doctrine have been plagued by logical fallacies and question begging assertions. As such, the debate over animal disenhancement forecasts an enduring conundrum with respect to the core question of transforming the nature of sentient beings, and this conundrum is logically independent of claims that relate either to the distinctive of human beings or to issues deriving from the emphasis on enhancement.

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Introduction

Like genetic manipulation, but perhaps with more realistic possibilities, nanotechnology is linked to a variety of post-human futures, where consciousness can be "downloaded" onto electronic media, where human sensory apparatus will be linked to spatially dispersed information gathering devices, where intelligence will be distributed amongst various brains and computing capabilities and where the vagaries of the human body will be bolstered by devices that increase its physical power and resistance to external threats. This paper will not engage the ethical and ontological issues of the distant post-human future directly. Instead, I will probe its opposite: the *dis*enhancement of non-human animals' capabilities in the present and near term, a set of technological possibilities exemplified by the blind chicken problem, discussed below. Here we have a set of ethical quandaries that have already been widely discussed, and yet, I will argue, little progress has been made in articulating exactly what the ethical issue actually is. I make no overt claims about the ethics of human enhancement, though my suspicion is that similarly inchoate concerns pervade this area as well.

A surprisingly large literature has developed in response to proposals for relieving distress that animals experience in certain food commodity production environments by means of technological alteration of animals' ability to experience distress. Blind chickens, who suffer less in crowded conditions than sighted birds, are emblematic of these proposals. They are discussed in the opening section of the paper. Although these proposals typically provoke powerful and highly negative moral responses, the animal welfare arguments in support of them should be taken seriously, as argued in the second section. The next three sections review the literature on animal disenhancement starting with the work of Bernard Rollin and moving on to his critics. The first group of critics argues against all genetic engineering of animals. They may be less relevant to the topic at hand than the second group, who argue that disenhancement itself is problematic, rather than the technical means for accomplishing it. Nevertheless, the larger point in reviewing this debate in the context of nanotechnology enabled human enhancement is to illustrate its inconclusiveness, so it is useful to touch on the full range of views. The two sections on Rollin's critics note a pattern of part/whole and type/token fallacies. In the concluding section, I argue that none of the philosophical attempts to resolve the contradiction between intuition and reasoned argument have been successful, and speculate that at least some responses to nanotechnology enabled enhancement of human cognitive capabilities will mimic the tensions and contradictions exhibited by this literature on the blind chicken problem.

Of Blind Hens

Viewed philosophically, the blind chicken problem dates to a 1999 paper written by a group of Danish researchers led by philosopher Peter Sandøe [29]. The paper discussed ethical issues raised by research on a strain of congenitally blind chickens that were less likely to exhibit signs of stress or agitation under crowded conditions. This suggested that blind chickens might be a response to some of the animal welfare problems in poultry production, notably the aggressive behavior of hens crowded together in the battery cage system of egg production that is, at this writing, still the most widely used approach in North America. The range of possible reactions was exhibited following a 2001 National Public Radio broadcast of the *Morning Edition* program focused on animal biotechnology where I said the following:

> There's a strain of chickens that are blind, and this was not produced through biotechnology. It was actually an accident that got developed into a particular strain of chickens. Now blind chickens, it turns out, don't mind being crowded together so much as normal chickens do. And so one suggestion is that, 'Well, we ought to shift over to all blind chickens as a solution to our animal welfare problems that are associated with crowding in the poultry industry.' Is this permissible on animal welfare grounds?
>
> Here, we have what I think is a real philosophical conundrum. If you think that it's the welfare of the individual animal that really matters here, how the animals are doing, then it would be more humane to have these blind chickens. On the other hand, almost everybody that you ask thinks that this is an absolutely horrendous thing to do [13].

Not only did I hear from acquaintances I had not seen in 20 years, I was subjected to numerous inquiries from strangers and a few angry phone calls from the U. S. poultry industry. Poultry producers challenged the suggestion that blind chickens were even being studied (they were wrong) and were irate at the suggestion that they would actually use them, but they were not the only ones who were hostile. For a time, an animal protection group posted a website claiming that I had advocated blinding chickens, urging their membership to write NPR in protest. One can still find a number of disapproving websites where I am described as a "philosopher" in quotation marks.

My critics seemed to think that I was actually promoting the use of blind chickens, though the original context of the David Kastenbaum story makes it even clearer than the quotation above that I was calling attention to the ethical reaction that most people experience when they hear this kind of experiment described. Perhaps they were objecting to the fact that I described it as a "conundrum." How could he think blind chickens could be more humane under any circumstances? But seeing that the blind chicken problem really is a conundrum is critical to

the relevance that this problem has for nanotechnology and the ethics of enhancement. Blind chickens are not products of nanotechnology, but we can expect to see an ever-lengthening list of converging technologies that mimic the ethical tensions of the blind chicken problem. I submit that a closer examination of blind chickens reveals a philosophical problem that will not easily be solved, and that will be the source of much confusion and possible mischief in future discussions of human enhancement. By framing the problem in connection to blind chickens instead of human enhancement, we may see that at least some dimensions of the philosophical problem can be generalized beyond ethical intuitions that we associate specifically with the human species. The fact that blind chickens currently exist and have been created using classical techniques of animal breeding indicates both that the kind of problem I have in mind is not "science fiction," and also that it is not uniquely tied to our ability to manipulate matter at the nano scale.

In the following section I will discuss some of the technological strategies for going beyond blind hens in very general terms. Understood as the convergence of molecular biotechnologies, information technology and materials science, nanotechnology will almost certainly be implicated in any actual attempt to pursue such strategies, if only because this convergence can be expected to play some role in the development of almost any technology that depends on manipulations at the cellular level. As Patrick Lin and Fritz Allhoff write, "With nanotechnology, so much is unknown that scientists are really not in a position to accurately forecast what is likely or not and by when," ([14], p. 12). As such, it is prudent to cast the net of nanoethics widely, and to discuss possible scenarios well in advance of our ability to identify specific technological applications (much less specific *nano*technological applications) that might lead to their realization.

Thus though the main point of this article does not depend upon the existence of nanotechnologies to accomplish ends analogous to congenitally blind hens, it is actually quite plausible to expect a connection between human enhancement nanotechnology and animal disenhancement, at least when considered in terms of technical capability. Some human enhancement technologies envision an interface with neurological activity. There is every reason to expect that the development of an interface technology for "nanoaugmentation" could also be utilized to selectively disrupt specific neural activities, including pain receptors or even sight. What is more, the initial development of such an interface will certainly be done on animal, rather than human brains. Any number of medical technologies, from vaccination to embryo transfer, have been developed and deployed in veterinary contexts well before their use in the human species. This is not to say that we should *expect* short-term application of neural interface technologies in agricultural settings. Costs may well be prohibitive over the short run, and might remain so. What is more, the conundrum noted above itself might dissuade food animal producers from adopting nanodisenhancement, should it become technically and economically feasible, just as they have thus far resisted blind hens.

Why Change Animal Nature?

In fact, the conundrum is both practical and philosophical. The practical dimensions may indeed be less relevant to nanotechnology and enhancement than the philosophical ones, but it may still be useful to develop the context in which technologies that seek the opposite of enhancement might realistically be deployed. Blind chickens are emblematic of a potentially large class of animals that are modified in response to so-called "production disease." Production diseases are animal pathologies that occur as a result of or in association with livestock production practices. Hens confined at high density in battery cages are prone to feather pecking and cannibalism, aggressive behaviors that may have a defensive, territorial function in the wild. In egg production systems, such behavior is harmful to other hens and leads to injuries that impose cost on the producer in the form of reduced production and increased veterinary care. Beak-trimming is one response to this "production disease," but trimming each individual hen's beak to limit pecking is itself harmful and costly. Other animals and other production practices lead to different production diseases. Large-breasted broiler chickens are susceptible to leg and muscle problems. High producing dairy cows are susceptible to mastitis. Many animals kept in confined settings exhibit obsessive, repetitive movements called stereotipies. In the wake of a global movement toward more

humane animal production, researchers are involved in a constant search for responses to these problems. Currently researchers are applying the techniques of genetic engineering, cloning, and cellular manipulation in search of ways to reduce both the suffering and economic cost associated with production disease, (see [35]), and surgical techniques, such as beak trimming, are widely used in industry. Nano-enabled devices or methods for disrupting an animal's ability to experience pain or distress would certainly be adopted if they were available on a cost-effective basis. Or would they?

It is useful to distinguish two conceptually different but equally radical routes to the technological solution to production disease. One might be called the *Dumb Down* approach. Here researchers identify the genetic or neurological basis for certain characteristics or abilities (such as sight), and produce animals that lack them by removing or otherwise disabling them either genetically or through a nano-mechanical intervention in cellular or neurological processes. The end result of a genetic process might be the headless commodity-producing organism described as "football birds" by Fred Gifford [9], though I believe that this is exceedingly unlikely. Surgeries that disrupt neurological processes, on the other hand, might well be feasible, and the question is whether some form of nano- or converging technology would make them cost effective. The alternative might be called the *Build Up* approach. Here, researchers work with cells *in vitro*, designing scaffolding and other mechanisms that might be produced according to instructions encoded in DNA, to wind up with an organism that yields the animal products (meat, milk and eggs) currently produced using pigs, cows and chickens, [7]. This approach might truly yield a quasi-living system that might even involve some elements of animate neural control of organ functions or muscle tension, but without a central nervous system or brain. The practical conundrum is that the need for a response to production disease suggests that agricultural researchers and the animal products industry should be pursuing both Build Up and Dumb Down research streams, though the potential for "yuck factor" responses on the part of the public suggest that perhaps they should not.

There is a philosophical conundrum here because our leading theories of animal ethics tell us that this would be a good thing to do, but our moral intuitions tell us that it is an absolutely horrendous thing to do. Philosophers have used the word 'intuition' in many ways, but here I refer to a large class of seemingly immediate and involuntary cognitive experiences. *Perceptual intuitions* are raw sensations, like the cylindrical white shape I now see against a dull gray background. The white shape is my coffee cup and the background is my desk. However, seeing them *as* my coffee cup and desk may involve additional processing that I could defer at will, but it is hard to imagine how I could not see these shapes, so long as I can see at all. *Linguistic intuitions* are the "sense" that we make of words and sentences when they are spoken or visually presented to us. Here, too, there is an involuntariness, a compulsive character that cannot be resisted. If someone says "Move over, loser," I can *pretend* that I have not heard, but I cannot actually choose whether or not I want to understand, (though I must, of course, understand English idioms to have this linguistic intuition). *Moral intuitions* are similar in that they are immediate, seemingly involuntary, and do not involve any conscious or thoughtful judgment. When confronted with a given situation (either in practice or, as above, by description), we just react to it as "wrong." It is quite possible that, as in the case of language, we are culturally educated into our moral intuitions, but this does not alter the fact that we seem unable to choose whether or not we will have them.

To use the term 'intuition' in this sense does not imply a commitment to intuitionism or any other moral theory holding that intuitions are morally authoritative. Indeed, the normal case is that intuitions blend seamlessly into more carefully considered judgments. In the case of moral intuitions, we typically experience no dissonance between our immediate reaction and the judgment we reach when we thoughtfully review a situation in light of moral principles. But despite their immediacy, intuitions are not always reliable. Sometimes we realize that what we thought we saw or heard was not in fact what was there, or what was actually said was not at all what we thought we heard. The same is true for moral intuitions. In many cases where our first reaction is to think that something is morally wrong, we may be brought around to the idea that it is not wrong after all by reasoning carefully about the situation and considering all of the relevant details. But some moral intuitions are quite robust, and our sense of rightness or wrongness about them may remain even when thinking more carefully about them fails to

support the initial reaction. Such intuitions produce conundrums.

The thought of blind chickens producing our table eggs is repulsive; it just strikes us as wrong. But leading theories of animal ethics do not support this judgment. Peter Singer's approach to animal welfare, for example, tells us that we should give equal consideration to interests, without regard to the animal that has these interests. We should take the suffering of animals into account in making our decisions and should not favor choices that produce trivial human benefits simply because the harm or suffering these choices cause happen to occur in non-human animals [32]. Relevant in the present case are interests in avoiding the suffering that is associated with production disease. Conventional animals have these interests, and experience the suffering. Modified animals lack the interests and do not experience the suffering. If our goal is to minimize the unnecessary suffering in the world, as utilitarian philosophers have advocated for over 200 years, the choice seems direct. Organisms that lack the capacity to suffer cannot be harmed, so taking steps to create such organisms seems to be what a utilitarian would have us do.

Perhaps, one might think, a stronger animal rights view would not support this. The position advocated by Tom Regan, for example, would not support the use of blind chickens, for example, because even blind chickens still have an internal life experience, a sense of present and past, and a capacity to live their lives in a manner conducive to their own individual proclivities and interests. They are, as Regan would have it, *subjects-of-a-life*, and it would be wrong to treat them solely as for our own purposes [19, 21]. Gifford's football bird, however, eliminates the capability of experiencing an internal life experience altogether. By Regan's own reasoning, animals (such as insects or protozoa) that lack any conscious capability altogether are *not* subjects-of-a-life. If we can develop an animal that produces meat, milk or eggs and is not a subject-of-a-life, there is nothing or no one to be harmed by doing so. Further, if doing that is a step toward removing ordinary pigs, cattle and chickens from the production circumstances where their rights are, in Regan's view, currently being violated, it would seem that his ethic of "empty cages" weighs in on the side of developing such literally mindless animals. Thus, to repeat, at least some versions of the blind chicken strategy seem to be supported by animal ethics, but almost everyone thinks that this would be an absolutely horrendous thing to do.

Is it possible that at least some of the moral revulsion expressed by authors who write about human enhancement is similar to the repugnance associated with blind chickens? I am tempted to think that it is, and that high-minded rhetoric stressing the uniqueness of human beings actually obfuscates whatever it is that gives rise to these moral intuitions. However, I will not probe the relationship between human enhancement and animal disenhancement further. Instead I will recount some of the efforts that philosophers have made to pinpoint the trouble that gives rise to an intuition that blind chicken strategies are wrong. My aim will be to show that these efforts are unsatisfactory to the point of being obfuscatory. Here I hint that debates over human enhancement have the potential to follow a similar trajectory, though, of course, that remains to be seen.

Animal Biotechnology and Animal Ethics

The basic conceptual elements of the Dumb Down approach were described over 20 years ago by Bernard Rollin [22], who gave an extended discussion of them in his 1995 book, *The Frankenstein Syndrome*. Rollin was thinking primarily of laboratory animals that would be genetically engineered to exhibit particularly devastating forms of human disease for the purpose of biomedical research. In Rollin's view, there are compelling ethical reasons to conduct research on these diseases, and animal models of genetically-based disease would be especially useful in developing therapies. However, the suffering that such animals would endure is tremendous. Because the entire point of creating these animals is to exhibit the disease, there would be no escape. How can this kind of genetic engineering for medical research be ethically justified, Rollin asked?

In partial answer to his own question, Rollin speculated that it might be possible to perform additional genetic engineering as a palliative to the suffering that animals created to model disease might endure. It might, for example, be possible to genetically modify the animal's pain receptors, so that the animal would not experience the torturous and continual pain associated with the disease process. He wrote that it might even be possible to

create totally decerebrate animals, animals that experience no conscious life at all. Such animals would have brain functions necessary to maintain breathing, blood circulation and other automatic life support processes, but would lack any capacity for conscious sensory stimulation or awareness [23, 24].

Rollin originally raised the possibility of animals that cannot suffer in the context of querying the circumstances under which it would be permissible to change an animal's *telos*, a term that he coined to indicate the genetically based needs, drives and behaviors characteristic of species, subspecies and breeds. His general answer to this question was the Principle of Welfare Conservation: technologically modified animals should not have worse welfare (susceptibility to disease and experience of pain or frustration) than unmodified animals of the same species or breed. Applying the Principle of Welfare Conservation to genetic engineering, Rollin argued that there is nothing intrinsically wrong with changing the genetic make-up of animals, so long as this change did not create animals that were more likely to experience pain, suffering or other deprivations of welfare as a result. Following the same animal ethics logic sketched above, Rollin presumed that organisms biologically incapable of conscious experience or awareness of pain cannot have compromised welfare. This logic was implicit in the first edition of Peter Singer's *Animal Liberation* [31] and it was made explicit by many animal advocates explaining why their concern for animals did not also extend to plants. Plants do not have a "welfare" in the relevant sense, though clearly they can be made better or worse off [36].

In short, Rollin concluded that a) genetic engineering is acceptable as long as the transgenic animal is not made worse off than comparable non-transgenic animals. But the compelling human needs addressed by transgenic animals developed to study disease presented him with a challenge. How can attempts to alleviate the horrible suffering of human victims of genetic disease be denied? So he further concluded that b) it is not only acceptable but desirable to render animals that would suffer under these conditions genetically incapable of experiencing suffering, that is to do genetic engineering that places them into something very much like a persistent vegetative state. If vegetables do not have a welfare that can be harmed, vegetative animals do not either. To put this as succinctly as possible, if we are to choose between two possibilities, one of which involves experimental animals enduring constant pain and suffering and the latter of which involves creating animals incapable of suffering (hence enduring none), the latter is, on Rollin's logic, obviously the preferable course of action. In his most recent book, Rollin has argued that animal models of human disease are permissible *only* if the researcher can describe some protocol for alleviating animal pain, though he has abandoned the view that decerebrate animals will ever be produced through genetic engineering [25]. Although he does not discuss nanotechnology in this connection, his view would appear to endorse any feasible nano-enabled device for achieving anesthesia or analgesia in animals of the sort he describes.

Rollin's writings have spawned a number of critics, who can be classified into three groups. Most have focused on element a), his claim that genetic engineering is acceptable in cases where the welfare of animals is not compromised. For this first group of critics any kind of genetic engineering is said to violate "species integrity" or the "dignity of the creature" [2, 5, 30]. Some of these critics (the second group) have followed Rollin's use of the term *telos* to describe the genetic basis of species-characteristic proclivities and drives, but have argued that it would be wrong to alter *telos* [8, 15]. Thus the key philosophical problem for this group of critics has been to express the basis for their objection in persuasive terms, and various linguistic innovations characterize their attempts. Of course it would be possible to argue that the "yuck factor" response is itself a morally sound argument, and this strategy represents the second and smallest group of respondents [18]. Critics in a final group (the third group) do not object to genetic engineering as such, but have questioned whether Rollin has characterized the sense in which an animal can be made worse off too narrowly [1, 3, 11, 34], and blind chickens might be a case in point. Are blind chickens "worse off" than sighted ones? We can consider each type of criticism in turn to see whether the conundrum is addressed.

Rollin's Critics: Against Genetically Engineered Animals

Critics in the first group argue that genetic engineering of animals is intrinsically wrong and have sought

some form of argument that at least mimics a Kantian categorical imperative. In this respect, they are making a philosophical argument that parallels the animal rights approach in animal ethics, but the authors I have cited above all appear to recognize that it is not an individual creature that is harmed by blind chicken strategies or modifications of *telos*, and that to the contrary, the individual animals are better off than they otherwise might be. As such, the "dignity of the creature" noted by Balzer, Rippe and Schaber is dignity in an abstract sense (see also [10], or perhaps it is the integrity of the animal that is being affected adversely [26, 38]. Rob De Vries [37] has undertaken a careful analysis of the way that the term 'animal integrity' has been applied to the evaluation of genetic engineering. His analysis shows that for authors who use these terms, 'dignity', 'integrity' or '*telos*' must be regarded as something characteristic of species or kinds, perhaps as articulated in the genome, and understood as capable of being harmed or disrespected even in cases where the individual is benefited.

In examining whether the tests De Vries notes can be met in a coherent manner it is worth following out the animal rights logic in a bit more detail. As noted already, it is unlikely that blind hens will win any endorsements from Tom Regan, yet the problem lies not with the fact that they less capable than sighted chickens. *Any* chicken kept in a cage will violate Regan's ethic of animal rights. What would a rights theorist say about the comparison between blind and sighted hens in egg production? Both cases violate rights, but isn't it a worse offense to inflict suffering on top of that? One general problem in applying rights theory to production disease is that the theoretical commitments of the rights view are so firmly opposed to the very idea of animal production that they seem wholly inapplicable to the ethics of making the best of a bad situation. But the blind chicken problem is not simply eliciting the intuition that keeping chickens in crowded environments is wrong. It is the further intuition that making the best of a bad situation (from the standpoint of the animal's subjective experience) is actually the wrong thing to do. This means that considerations relevant to species or kinds would override the rights of actual animals (i.e., the individuals who instantiate those species or kinds), and this is something that Regan has argued against time and time again [19, 20].

It is possible that something like violation of dignity or integrity captures the essence of a widely felt aversion to biotechnology (see [16]). At the least, the language of *telos* and species integrity gives people something to latch on to. Furthermore the terminology of integrity permits a public airing of the issues, and Bernice Bovenkirk, Frans Brom, and Babs van den Bergh [3] have argued that this is itself the primary argument for adopting this kind of language. But these responses are still opposed by several key points that remain in Rollin's favor. One is that biotechnology can be used to help people *and* animals, to better their lives. Appeals to integrity and dignity can become pompous when thrown in the face of creatures (of whatever species) who are actively enduring suffering right now. Second, the claim that it is wrong to violate species integrity, the dignity of the creature or *telos* seems to overstate the case. At a minimum, critics would need to explain whether such arguments would also forbid routine forms of animal breeding [28]. Bovenkirk, Brom and van den Bergh admit this point, describing the concept of integrity as "flawed but workable," ([3], p. 20).

Whatever disclaimers are issued by these authors, the rhetoric of dignity and integrity makes it sound as if actual animals are harmed by manipulations of DNA in a Petri dish. The arguments of Bovenkirk, Brom and van den Bergh seem especially problematic, as they explicate the concept of integrity in connection to human beings and environments, illustrating that it is possible to damage the integrity of either while nevertheless doing things that might be thought good for them from a utilitarian perspective. But in both cases, it is actual people or actual ecosystems that bear the brunt of such an affront. As Rollin himself has argued vehemently, species integrity, dignity and *telos* are abstractions intended to describe animals as types; they do not describe actual, living and breathing animals at all [24]. The point here is that all these objections to Rollin border on, if not actually committing, something between a division fallacy and a type-token fallacy, a confusion between the description or conceptualization of certain interests exhibited by a class of individuals and the actual interests of individuals so classified. Even if it makes sense to say that there is something to debate with respect to species integrity or dignity, it is a confusion to presume that this has anything at all to do with the integrity or dignity of individual animals.

It is also worth noting that Rollin's arguments on transgenic animal disease models differ from the blind chicken problem in important respects. First, there are no human patients anxiously awaiting a cure that provide the ethically compelling force that motivates his entire argument. Second, Rollin's mouse models for human disease were being made worse off through genetic engineering, and "decerebration" was offered as a compensating response. In the case of production disease, there are alternative ways of improving animal welfare, namely, improve the environment. Thus these cases are not strictly comparable. On the one hand, blind chickens or football birds seem to more problematic than decerebrate mice because there is no reason to think that creating them is the only way to address a compelling need. On the other hand, it is doubtful that either the Dumb Down or Build Up strategies violate Rollin's criterion of the Conservation of Welfare. These animals have *improved* welfare relative to the normal animals in the comparison class, albeit because they are incapable of having their welfare compromised in the normal way. The welfare of a football bird or a neurologically nano-disabled pig may be zero, but zero is better than less than zero.

Rollin's Critics: The Trouble with Disenhancement

This brings us to the second and third groups of critics, all of whom are focused specifically on livestock rather than disease model biotechnology. These critics are not explicitly attempting to develop arguments that would oppose all forms of genetic engineering applied to animals, though is it not entirely clear what forms of modification *would* be acceptable. Importantly for the present case, the focus of the argument is on modifications that can be understood as disenhancements. Here, the argument is that we would quite reasonably think that a blind chicken is worse off than a sighted one, that strategies to reduce the mental or experiential capacity of animals actually violate Rollin's principle of conservation of welfare.

As noted above, one possible response is simply to accept the disquieting intuitions as definitive: we feel like this is wrong, so it is. This form of argument was put forward by Leon Kass in a widely read response to animal cloning entitled "The Wisdom of Repugnance" [12] and was reiterated as a general indictment of biotechnology in the domain of foods (and especially animal foods) by Mary Midgley [17]. Neither Kass nor Midgley was responding directly to Rollin, however. A paper by Sara Ortiz [18] provides a careful discussion of the literature generated in response to Rollin's argument, concluding simply that the thrust of these critiques is to take the objection to biotechnology "beyond welfare," as if that were enough. However, Ortiz's analysis is useful here in part because in admitting (or in the spirit of her analysis it might be more appropriate to use the word "recognizing") that these arguments not only fail to engage animal welfare concerns but may in fact run counter to them, she also recognizes that there *is* a conundrum here.

In simply siding with our intuitions, however, authors like Kass, Midgley and Ortiz appear to accept an analysis which admits that that there are no operative reasons at work and no real moral argument that can be deployed to support the conclusion they wish to endorse. Indeed, Rollin himself seems to agree with this judgment when he, in virtually every paper cited above, expresses doubt that such applications of biotechnology will ever come into being because the public's aesthetic response will make the products unmarketable. But in calling this an aesthetic response, Rollin is also stating that it has no moral force. It is, in fact, a form of aesthetic revulsion that, however decisive it may be in determining the economic fate of eggs from blind chickens, appears to morally unjustified in the face of practical opportunities to alleviate the distress of farm animals suffering from production disease. Thus although this second group of critics is making a different type of argument than the first, they, too, seem all too willing to condone the continuation of real harm to animals.

Critics in third group want to claim that disenhancements are, in fact forms of harm to actual animals. Bovenkirk, Brom and van den Bergh's discussion of animal integrity (discussed above) is, in fact, intended to make such a claim, rather than being put forward as a catch-all objection to genetic engineering. They, like Allan Holland [11] and Mike Appleby [1], frame the critique in terms of the need to respect what it is animals, by nature, typically are. Appleby cites the Brambell Committee's injunction that animals should be able to engage in natural behaviors [4]. For Appleby, the argument begins with a now fairly standard characterization of animal

welfare in terms of animal bodies (e.g., physiological and veterinary health), animal natures (behavioral drives) and animal minds (subjective experiences such as pain or satisfaction). Appleby's claim is that animal natures are defined by species typical norms. Thus, blind chickens are worse off than sighted chickens simply because they are blind.

The counter argument to Appleby holds that behavioral drives should be recognized as relevant to the welfare of animals that actually have these drives. Though animal welfare scientists often focus on species-typical data to identify behavioral drives, the justification for doing this is methodological, rather than ontological. In fact, the presumption is that these drives are genetically based; hence changed genetics should change drives. What is more, some behavioral drives are clearly related to conditioning rather than species-typical norms. An animal that has been conditioned to fear human beings will have its welfare compromised on simply seeing one. It is in that animal's nature to fear the presence of humans. This kind of reaction may not be "species typical," but that fact provides no basis for claiming that these conditioned responses are irrelevant to a given animal's welfare. Appleby is thus just wrong to equate animal natures with species-typical norms. What matters is whether a given animal's nature is compromised, and this may have nothing to do with what is typical for the species.

Holland's quasi-Kantian argument suggests that we are disrespecting the animal itself when we undertake measures that alleviate suffering so that we may continue in what is, at bottom, an exploitative relationship. Thus, blind chicken strategies are like offering assembly line workers an aspirin in lieu of better working conditions. Both are responses that ameliorate distress, but do so in a way that is an affront to the dignity of the distressed individual. I am myself the third critic in this second group, and I offered two criticisms in a 1997 paper [34] that also includes much more detailed discussion of some reasons to think that those who have chosen to articulate the problem in terms of integrity or dignity have gotten it wrong. In that paper I argued that Rollin's *Principle of Conservation of Welfare* could as easily be applied to behavioral or surgical interventions as to genetic research, but that here we would be reluctant to think that eliminating a capacity or felt need makes an animal no worse off than it was before. I also offered the following claim:

> Clearly the *telos* that is characteristic of any species (including humans) is instantiated only in the individuals of the species. If we recognize immorality in acts that would modify a human genome to the point that the resulting individual would no longer be characteristic of the human species, why is it not also immoral to modify the genome of other animals so that the resulting individuals are uncharacteristic of their species? Until someone can offer a non-arbitrary reason for making this distinction, radical forms of transgenesis for animals should be regarded as morally problematic ([34], p. 20).

Today, I am not confident that any of these objections do more philosophical work than the suggestion that we err because we violate the integrity or dignity of animals. I would submit that the approaches of Holland, Appleby and myself all have the virtue of avoiding the most egregious logical fallacies and the misleading tone of the other critics, but I am not sure that anyone has done anything much more that paste a philosophical label on the "yuck factor" intuition that blind chicken problem provokes. My own treatment is particularly vulnerable to this criticism.

It is one thing to talk about natural behavior or an animal's nature as constructs that are intended to call attention to an animal's entire life, or to the way that it fits within its farm environment. This kind of talk may be useful in calling our attention to how farm animals actually fare. It is precisely this point that Bovenkirk, Brom and van den Bergh have in mind when they defend the term 'integrity.' It is something else again to say that such talk provides a unilateral argument against adjusting the fit between animal and environment by adjusting the animal, rather than the environment. 'Integrity' or 'animal nature' may give us terms on which to hang our considered moral intuition that there is something wrong with blind chickens, football birds and the Dumb Down strategy in general, but it is a response that invites us to conflate actions that actually cause harm to real, live farm animals with actions that actually relieve harm, when compared to the alternative that would be most likely to prevail. It is only when our understanding of actual welfare associated with possible alternative

courses of action is in view that the considerations of animal ethics have force. All of the options thus far considered for explaining why blind chickens and the Dumb Down approach might be morally wrong do so by taking our attention away from the conditions in which animals *actually* live.

Resolving the Conundrum or Admitting Defeat

Is it possible to resolve the blind chicken conundrum? In fact, I think not, but there are a number of lingering points that must be addressed before admitting defeat. First, we must recognize that a driving factor behind the persistence of our intuition that there is something wrong here may well be the presumption that there are other, more straightforward ways to address livestock production disease. Why not give the chickens more room? In fact, the answer to a question like this is very similar to the answer that factory owners might give to someone who takes them to task for offering aspirin rather than improving working conditions: it's easier said than done. In fact, chickens in non-cage systems also experience stress associated with visual stimulation, though in their case it may have more to do with large group size than crowding. In any case, beak trimming is believed to be necessary in virtually all egg production systems that operate at a commercially-viable scale [27, 33].

A thorough discussion of animal production disease would take the present inquiry into the details of diverse agricultural commodity markets and animal production systems, trying the patience of any reader interested in the ethics of nanotechnology or human enhancement. It must suffice to say that technological responses to the animal welfare problems associated with livestock production disease become ethically attractive when seemingly more desirable correctives become difficult if not impossible to implement in the face of political and economic circumstances. Of course the very repugnance these responses provoke can also change those circumstances. The practical, agricultural ethics of production disease will depend very much on where one sits and the choices that one has. To the extent that political and economic realities remain what they are, it is important for anyone involved in livestock production to at least consider the argument for blind chickens.

Thus if one possibility is simply to go with the "wisdom of repugnance," another possibility is to accept the possibility that what ethical theory tells us is right, and that our intuitions are simply mistaken in this family of cases. In this connection, it is worth noting that the Build Up and Dumb Down strategies actually engage our intuitions in somewhat different, if also overlapping, ways. The reaction to Build Up may simply be, "Yuck. I don't want to eat that." Manipulating cells in a Petri dish does not seem on the face of it to involve moral concerns, and the organisms that will result from this line of research seem distant enough from actual chickens for one to plausibly claim, "No animals were harmed in producing this meal." Although built up organisms might still face the aesthetic revulsion that Rollin sees as the primary barrier to football birds, I, at least, would be inclined to say that willfully choosing animal suffering over this approach is morally problematic in a fairly straightforward way. In contrast, the intuitive rejection of Dumb Down strategies puts morality into play in a way that (*prima facie*, at least) counters the arguments from animal welfare: it's not only disgusting and distasteful, it's morally wrong.

The persistence of this intuition suggests that the blind chicken problem is a problem for human conduct in itself and not in regard to its impact on animals. It is our attitude to animal natures that troubles Appleby and Holland, but this attitude does no harm to the organism that emerges at the convergence point between Dumb Down and Build Up. That organism lacks the capacity to be, in Tom Regan's terms, the subject of a life. There is no subject there to which we can show disrespect. Were we to come upon such an organism existing in nature, would using it agriculturally provoke any distasteful intuitions at all? It seems unlikely. The problems seem to arise in connection with setting out to displace familiar animals in favor of this mindless blob. Contrary to the quasi-Kantian elements in Holland's analysis, it is not so much that doing so shows disrespect to any actual sheep, pig, cow or chicken. Indeed, perhaps we will continue to associate with much smaller numbers of them in mutually satisfactory settings. The problem seems to be that the entire project exhibits the vices of pride, of arrogance, of coldness and of calculating venality. The suspicion that a more radical restructuring of industrial animal production might alleviate the need for blind chickens reinforces this presumption (see [6]).

To put the point another way, it is not the disrespect that animals *suffer* that is focus of what is wrong with blind chicken strategies. It is disrespectfulness as a pattern of behavior or a character trait on the part of the agent that is at the heart of the issue. In this connection, Holland's analysis can be seen to trade upon an ambiguity associated with the word 'respect'. In its usual Kantian connotation, respect is owed to others, and we say that they are harmed when they do not get it. I take it that this is exactly what Holland intends when he says that blind chicken strategies disrespect animals even while alleviating their distress. But respectfulness is a virtue that can describe the character of a person even when their actions in particular circumstances achieve less than they might like. To revisit one last time the analogy to assembly line workers whose dignity is offended by the offer of aspirin in lieu of better working conditions, we might perceive a factory owner up against the wall of economic competition far more favorably than the market leader who sets the terms of competition. It is not that workers in the latter's factory are harmed in a manner that workers in the former's are not. It is the relative virtue or character of each owner that is at issue in marking the moral difference.

Can we then say that our intuitions about the wrongness of blind chickens are captured when we articulate this as a problem in human virtue, a problem with the kind of moral character that people who would do such a thing might have? If so, does this answer carry over to the qualms that may be felt about human enhancement? I am not sanguine with a positive response to either question, though at present I have nothing more insightful to offer. The suggestion that we can draw upon virtue ethics resituates the philosophical problem by shifting our attention away from a better account of harm to animals and toward those practices and traditions we associate with good and bad moral character. But it is hardly clear that resituating the argument this way makes it any more convincing. We are still left with the practical problem of suffering from production disease and thus we are still left with a conundrum.

The more important point to draw is that the inchoate nature of concerns about blind chickens has spawned a minor industry of linguistic innovation, where various forms of intrinsic value, species or animal integrity, dignity and *telos* have been proffered as the thing being harmed, compromised or offended. Despite Bovenkirk, Brom and van den Bergh's [3] suggestion that such innovations at least give us a way to express the fact that many of us think that this is an absolutely horrendous thing to do, these terms do little or nothing to articulate *why* it is wrong. It is not altogether clear that resituating the moral issue as one focused on the virtue of the agents is an improvement, either. My conjecture is that the coming debate over nano-enabled human enhancement will find itself facing analogous conundrums, allegedly resolved by analogous terminological innovations. As noted at the outset, we should expect that any interface for neural enhancements will also enable disenhancements, as well. But more generally, the gap between persistent intuitions and explicitly articulated moral concerns looms large for the debate over human enhancement itself. Too often linguistic innovations that name our inchoate concerns also allow us to neglect our responsibility to probe the basis and legitimacy of our moral intuitions. It may even encourage us to think that we have resolved a conundrum when we have, in fact, done nothing more than conceal it.

References

1. Appleby MC (1999) What should we do about animal welfare? Blackwell Science, Oxford
2. Balzer P, Rippe KP, Schaber P (2000) Two concepts of dignity for humans and non-human organisms in the context of genetic engineering. J Agric Environ Ethics 13:7–27
3. Bovenkirk B, Brom FWA, van den Bergh BJ (2001) Brave new birds: the use of integrity in animal ethics. Hastings Cent Rep 32(1):16–22 doi:10.2307/3528292
4. Brambell FW (1969) Report of the technical committee to enquire into the welfare of animals kept under intensive livestock husbandry systems. Her Majesty's Stationery Office, London, UK
5. Colwell RK (1989) "Natural and unnatural history: biological diversity and genetic engineering". In: Shea WR, Sitter B (eds) Scientists and their responsibilities. Watson Publishing International, Canton, OH, pp 1–40
6. Davis K (1996) "The ethics of genetic engineering and the futuristic fate of domestic fowl". United Poultry Concerns Website. Available at http://www.upc-online.org/genetic.html (accessed January 13, 2006)
7. Edelman PD, McFarland DC, Mironov VA, Matheny JG (2005) *In vitro*-cultured meat production. Tissue Eng 11:659–662 doi:10.1089/ten.2005.11.659
8. Fox MW (1990) "Transgenic animals: ethical and animal welfare concerns". In: Wheale P, McNally P (eds) The

bio-revolution: cornucopia or pandora's box. Pluto, London, pp 31–54
9. Gifford F (2002) "Biotechnology". In: Comstock G (ed) Life Science Ethics. Iowa State, Ames, IA, pp 191–224
10. Heeger R (2000) Genetic engineering and the dignity of creatures. J Agric Environ Ethics 13:43–51
11. Holland A (1995) "Artificial lives: philosophical dimensions of farm animal biotechnology". In: Mepham TB, Tucker GA, Wiseman J (eds) Issues in agricultural bioethics. University of Nottingham, Nottingham, pp 293–306
12. Kass L (1997) "The wisdom of repugnance". The New Republic June 2:17–26
13. Kastenbaum D (2001) "Analysis: debate over genetically altered fish and meat". *Morning Edition* (December 4, 2001). Transcript available online at http://www.npr.org. http://www.npr.org/templates/story/story.php?storyId=1134248 (accessed June 25, 2008)
14. Lin P, Allhoff F (2007) "Nanoscience and nanoethics: defining the disciplines". In: Allhoff F, Lin P, Moor J, Weckert J (eds) Nanoethics: the ethical and social implications of nanotechnology. Wiley-Interscience, Hoboken, NJ, pp 3–16
15. Mauron A (1989) "Ethics and the ordinary molecular biologist". In: Shea WR, Sitter B (eds) Scientists and their responsibilities. Watson Publishing International, Canton, OH, pp 249–265
16. McNaughton P (2004) Animals in their nature: a case study on public attitudes to animals genetic modification and 'nature'. Sociology 38:533–551 doi:10.1177/0038038504043217
17. Midgley M (2000) Biotechnology and monstrosity. Hastings Cent Rep 30(5):7–15 doi:10.2307/3527881
18. Ortiz SEG (2004) Beyond welfare: animal integrity, animal dignity and genetic engineering. Ethics Environ 9:94–120 doi:10.2979/ETE.2004.9.1.94
19. Regan T (1983) The case for animal rights. University of California Press, Berkeley
20. Regan T (1995) "Are zoos morally defensible?". In: Norton BG, Hutchins M, Stevens EF, Maple T (eds) Ethics on the ark. Smithsonian Institution, Washington, DC, pp 38–51
21. Regan T (2003) Animal rights, human wrongs: An introduction to moral philosophy. Rowman and Littlefield, Lanham, MD
22. Rollin B (1986) "The frankenstein thing". In: Evans JW, Hollaender A (eds) Genetic engineering of animals: An agricultural perspective. Plenum, New York, pp 285–298
23. Rollin B (1995) The frankenstein syndrome: Ethical and social issues in the genetic engineering of animals. Cambridge University Press, New York
24. Rollin B (1998) "On telos and genetic engineering". In: Holland A, Johnson A (eds) Animal biotechnology and ethics. Chapman and Hall, London, pp 156–187
25. Rollin B (2006) Science and ethics. Cambridge University Press, New York
26. Rutgers B, Heeger R (1999) "Inherent worth and respect for animal integrity". In: Dol M, Fentener van Vlissingen M, Kasanmoentalib S, Visser T, Zwart H (eds) Recognizing the intrinsic value of nature. Van Corcum, Assen, pp 41–53
27. Savory CJ (1995) Feather pecking and cannibalism. Worlds Poult Sci J 51:215–219 doi:10.1079/WPS19950016
28. Sandøe P, Holtung N, Simonsen HB (1996) Ethical limits to domestication. J Agric Environ Ethics 9:114–122
29. Sandøe PB, Nielsen L, Christensen LG, Sørensen P (1999) Staying good while playing God—the ethics of breeding farm animals. Anim Welf 8:313–328
30. Sapontzis SF (1991) We should not manipulate the genome of domestic hogs. J Agric Environ Ethics 4:177–185 doi:10.1007/BF01980315
31. Singer P (1975) Animal liberation. Avon Books, New York
32. Singer P (2002) Animal liberation, revised edition. Harper-Collins, New York
33. Tausin R (2002) Furnished cages and aviaries: production and health. Worlds Poult Sci J 58:49–63 doi:10.1079/WPS20020007
34. Thompson PB (1997) Ethics and the genetic engineering of food animals. J Agric Environ Ethics 10:1–23 doi:10.1023/A:1007758700818
35. USDA (United States Department of Agriculture) 2006. "ARS Project: identification and manipulation of genetic factors to enhance disease resistance in cattle." Available at http://www.ars.usda.gov/research/projects/projects.htm?ACCN_NO=405817&showpars=true&fy=2003 (accessed January 13, 2006). Page last modified Jan. 12, 2006
36. Varner G (1990) Biological functions and biological interests. South J Philos 27:251–270
37. de Vries R (2006) Genetic engineering and the integrity of animals. J Agric Environ Ethics 19:469–493 doi:10.1007/s10806-006-9004-y
38. Warkentin T (2006) Dis/integrating animals: ethical dimensions of the genetic engineering of animals for human consumption. AI Soc 20:82–102 doi:10.1007/s00146-005-0009-2