Articles

Gene Doping—in Animals? Ethical Issues at the Intersection of Animal Use, Gene Editing, and Sports Ethics

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Abstract: Gene editors such as CRISPR could be used to create stronger, faster, or more resilient nonhuman animals. This is of keen interest to people who breed, train, race, and profit off the millions of animals used in sport that contribute billions of dollars to legal and illegal economies across the globe. People have tried for millennia to perfect sport animals; CRISPR proposes to do in one generation what might have taken decades previously. Moreover, gene editing may facilitate enhancing animals' capacities beyond their typical limits. This paper describes the state of animal use and engineering for sport, examines the moral status of animals, and analyzes current and future ethical issues at the intersection of animal use, gene editing, and sports. We argue that animal sport enthusiasts and animal welfarists alike should be concerned about the inevitable use of CRISPR in sport animals. Though in principle CRISPR could be used to improve sport animals' well-being, we think it is unlikely in practice to do so.

Keywords: animal ethics; gene editing; sports; sports ethics; CRISPR; gene doping

Since CRISPR's discovery in 2012, many bioethicists have been debating its use in human embryos. Yet CRISPR's use goes far beyond editing the human germ line; it is a powerful, efficient, and reliable tool for editing genes in any organism. It has garnered significant attention among biologists, as well as so-called "biohackers," interested in editing the genomes of nonhuman animals (hereafter: "animals") for a variety of purposes, such as refining biomedical research involving animals, increasing food production, or eliminating disease-causing insects and animals. But one use of genome editing has received almost no attention in ethics literature: editing animals that are bred for sport. This paper fills that gap and explores ethical issues surrounding "gene-doping" in sport animals.

Many readers will be acquainted with horse racing, hunting, rodeos, and perhaps dog-sledding. But there are many more sports and pastimes involving animals, such as greyhound racing, cockfighting, disc dog, dressage, foxhunting, polo—the list could go on. Millions of animals participate in sport every year and contribute billions of dollars to local, national, and global (not to mention black-market) economies. Sports involving animals are popular in many places across the globe.

Gene editing could be used to create stronger animals, faster animals, or more resilient animals—all in the course of one generation. We know there is an appetite for this. Animal owners have used selective breeding for millennia to produce animals with desired traits. There is ample evidence of using medications to "dope" animal athletes to gain a competitive edge.[1] Finally, "biohackers" and geneticists around the world have begun working with sport animal enthusiasts to map animal genotypes and identify mutations that give animals an advantage in sports, all with an eye toward creating genetically enhanced sport animals.[2]

From an ethical perspective, one might welcome the use of CRISPR to create enhanced sport animals. It might cut down on the number of animals destroyed in pursuit of the perfect sport animal. It could be used to dull pain sensation, a serious

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welfare concern for animals that compete in endurance sports. However, we are concerned that the use of CRISPR could perpetuate, if not exacerbate, animal abuses. We lay out these concerns and argue that animal sport enthusiasts and animal welfarists alike should be concerned about the use of CRISPR in sport animals. Though in principle CRISPR could be used to improve animals' well-being, we think it is unlikely in practice to do so.

Humans and (Sport) Animals

Ethical Debates about Animal Use

Although there are few ethical analyses of animal use in sport specifically, there is a long philosophical tradition that grapples with the moral status of animals and attempts to understand the moral relationship between humans and animals more generally. We situate ourselves in a tradition of thinking about moral status that acknowledges degrees of moral status.[3] According to this view, moral status varies with organisms' capacities, e.g., the capacity to feel pain and pleasure, consciousness, self-awareness, moral agency, participation in meaningful relationships, language, and so on. Capacities generate interests. Mice, by virtue of having the capacity to feel pain, have an interest in not being subjected to pain. Asserting that animals have a capacity to feel pain does not entail that animals have higher-order or self-reflexive thoughts about being in pain. Rather, we accept R.G. Frey's assertion that every animal's life is

> an unfolding series of experiences, that, depending on their quality, can make that creature's life go well or badly. Such a creature has a welfare that can be positively and negatively affected, depending on what we do to it, and with a welfare that can be enhanced and diminished.[4]

Insofar as any sentient creature's welfare is diminished by feeling pain, the animal has an interest in avoiding it.

Some animals have additional interests, as marked by additional and sometimes more complex capacities, and this allows for a weighting of interests. We can infer animals' interests by watching their behaviors. Examples include a cow exhibiting signs of depression when her calf is taken away to slaughter, a pig exhibiting signs of elation when reunited with a lost sibling, and a parrot choosing to solve a puzzle without any extrinsic food reward. These capacities give rise to interests in remaining united with kin and game-playing, respectively. Humans, by having the capacity for moral agency, also have an interest in preserving their agency. In virtue of being able to adopt abstract values, reason, and form intentions to act in self-directed ways, humans have an interest in preserving their autonomy.[5] It is possible to create a hierarchy of interests based on how much is "at stake" for the animal. Humans' interests matter more than mice's interests because there is more at stake for humans. This view permits degrees of moral status ordered by the weightiness of interests. It is consistent with this view that we have some obligations to mice, e.g., to avoid or at least reduce pain and suffering; but since human interests matter more, we are also justified in using mice, thereby thwarting their interests, to advance human interests. For examples, humans' interest in health might matter more than mice's interest in pain avoidance, and so when we consider

whether the use of mice in biomedical research is justified, it is justifiable to place more weight on protecting humans' health than on avoiding mice's pain. This view differs from an equal considerations approach to interests, which would stipulate that humans' interests and mice's interests merit equal consideration, even though their interests are different.

Animals' interests could serve as the ground for animals' rights.[6] For example, an interest in avoidance of pain grounds a duty to avoid inflicting pain, and a correlative right to freedom from pain. But as with human rights, it is sometimes justifiable to override animals' rights. Humans have a right to life, but that right can (arguably) be justifiably overridden in the course of a just war. Animals have a right to a life free of pain, but that right can (arguably) be justifiably overridden in the course of important biomedical research. Figuring out when humans are justified in overriding animals' rights is partly a matter of weighing interests. It is also the focus of much of the research in animal ethics.

Two key questions must be analyzed in the context of sports involving animals: (1) Does participation in sport advance, violate, or otherwise thwart animals' interests? (2) Does the advancement of humans' interests through the use of animals in sport justify the use of animals in ways that violate their interests and override their rights? The answer to the first question varies by sport. So-called blood sports, which by definition involve seriously maiming or killing an animal, are always contrary to animals' interests. But other sports do not necessarily contravene an animal's interest, for example, competitive disc dog (throwing Frisbees to dogs). The extent to which participation in sport goes against the animal's interests weighs heavily in the ethical assessment of the practice. The answer to the second question is more complicated and depends on many factors. It is possible that even in the case of a sport like hunting, which is contrary to hunted animals' interest and often involves a rights violation, competing human and nonhuman interests such as preventing overpopulation and protecting ecosystems might justify hunting.

History of Animal Use in Sport

There is ample historical evidence that humans have long used animals for sport and entertainment, being just one way in which humans have for millennia exercised dominion over animals. There is evidence of hunting for sport as early as 2050 BCE, when hunts were organized for the ancient Sumerian ruler Shulgi.[7] Cockfighting is thought to have originated over 2700 years ago in the Indus River valley in modern-day Pakistan before making its way around the world.[8] Chariot racing was part of the ancient Olympic Games, which were first recorded in Greece in 776 BCE but are thought to have begun in the ninth century BCE.[9] Polo is said to have originated in an ancient Persian game called *chogan* in the fifth century BCE, and eventually moved East, where it took root in China during the Tang dynasty (618–907 CE).[10] Though tradition is not an acceptable ethical justification for a practice, the embeddedness of animal use in sport in the history of human civilization explains in part why the practice remains prevalent today.

Another important part of explaining why animal sports remain prevalent today is money. Sport animal ownership is lucrative. For example, there were over 42,000 thoroughbred horse races in the United States and Canada in 2017. The total purse, or amount won by owners of the horses, topped $1.1 billion.[11] Retired male horses put out to stud can bring in hundreds of thousands of dollars, even more

for horses with a winning track record.[12] Race horses and other sport animals are not merely property, but investments.

Animal sports are intertwined with both legal and illegal gambling as well as advertising. Gambling brings in big money to bookies, arenas, and off-track betting establishments, as well as winners. Rodeos and dog sled races are financed largely by sponsors, who profit from advertising opportunities at the events. Finally, animal sports are an important part of local economies where they are popular. According to the British Horse Industry Confederation, horse racing employs about 90,000 people directly and indirectly and generates £3.7 billion a year for the British economy.[13]

The ethical arguments presented in our paper run up against both a long history and important cultural tradition of animal use in sport as well as an economic incentive to keep up the status quo if not grow enthusiasm for animal sports. Three responses to animal use in sports are available: abolitionist, welfarist, and fatalist. The abolitionist response says that the only ethical way forward is to abolish animal sports entirely. An abolitionist might argue that humans' social, cultural, and financial interests could never justify overriding animals' interests, and rights, to a life free of pain. A fatalist response soberly acknowledges that the status quo of animals' participation in sport is unlikely to change—aptly expressed with the phrase, "The horse is out of the barn." We adopt the third position. The view about animals' moral status defended above supports a welfarist approach to animal use. The best way forward is to consider the ways in which animals' interests and welfare could be advanced within sport participation, while at the same time promoting humans' interests as well. A welfarist will point out ways in which animals' interests—and rights—are abrogated by sport participation, and gene editing too, and advocate for measures to protect animals' interests, welfare, and rights.

Perfecting—and Enhancing—the Sport Animal

Just as humans have used animals in sport for thousands of years, humans have tried for just as long to breed and to raise animals for peak sport performance. The desired traits vary by the qualities associated with peak performance in each animal sport. For example, animals bred for use in fighting (e.g., cockfighting or dog fighting) tend to be selected for aggressiveness, while animals bred for racing tend to be selected for speed and recovery time.

There have been attempts to enhance sport animals beyond their typical limits, using some of the same medications that have been used to "dope" human athletes. A review of the ways in which sport animals have been perfected and enhanced through breeding and medicating shows that it is not a stretch to think that gene doping may be utilized as the technology becomes available.

Selective Breeding

Breeding animals for sport is a prevalent example of genetic engineering, which means we must ask whether intentionally manipulating the genomes of animals is technically or morally different than what we already do. Choosing specific animals to reproduce based on their physical traits has occurred for the entire history of animal sports. Human breeders rely on the partial genetic basis for characteristics

associated with sport animal success, such as strong musculature, endurance, intelligence, herding instinct, speed, and aggression, to create a business on the probability that mating animals with these traits will lead to similarly endowed offspring. Those who wish to raise a winning racehorse sometimes pay hundreds of thousands of dollars for a "stud fee," meaning creating the circumstances that will cause a male horse with desirable traits and/or a winning record to copulate once with their female horse.[14] Animal offspring bred for sport that demonstrate even hints of their parents' traits will be raised in an intense training environment to help those traits flourish, and those who do not demonstrate potential will be sold, abandoned, or killed.

Traditional breeding historically has depended on having a good eye for spotting talent and physical fitness, but breeding horses is now aided by genome sequencing. Genetic tests screen possible mates for desirable genotypes. The horse genome was sequenced in 2009, and shortly thereafter, Emmeline Hill, an equine geneticist, discovered a single gene associated with favorable racing distance. Her company, Dublin-based Equinome, offers genetic testing to owners and trainers, including one based on the "speed" gene. A rival company, Thoroughbred Genetics Limited, creates genetic profiles of horses and serves as a matching service. Over the last decade, Thoroughbred Genetics Limited has used whole genome analysis from thousands of animals to identify markers linked to equine stamina, strength, respiratory system, and energy use. It claims that its techniques are 75% better than conventional nongenetic methods of choosing winners from a group of horses.[15]

Chemical Animal Enhancement

Chemical enhancement refers to the provision of chemical substances, sometimes medications, to gain a competitive edge. Attempting chemical enhancement of animals is seen in countless animal sports, and dates back thousands of years. Instances of doping date back to Ancient Rome. Chariot riders at the time were banned, and sometimes even beheaded, for using "magic" on their horses to gain a competitive edge.[16] The administration of drugs and other substances to sport animals is intended to enhance the animals' performance beyond what they would typically be capable of—either by dulling pain or enhancing speed, aggressiveness, or other capacities.

The provision of chemical substances to sport animals is largely unregulated and almost categorically harmful to the welfare of the animal. Examples abound in many popular sports today. Anabolic steroids, industrial solvents, and narcotic stimulants, e.g., cocaine, have been forcibly given to racing greyhounds. The introduction of these drugs is known to lead to toxicosis, seizures, and behavioral abnormalities. The dwindling industry of dog racing encourages cheating, and shrinking budgets compromise the care of the dogs. A trainer in Florida was discovered to have twelve dogs under his care test positive for cocaine on eighteen occasions and was reprimanded with only a license suspension.[17] Trainers are rarely investigated as it is difficult to procure solid evidence of intent. Several countries and US states ban dog racing. In places where it is legal, such as the US state of Florida, it has been politically difficult to pass legislation that would criminalize doping dogs.[18]

Sled dogs carry equipment, food, and humans across icy tundra for hundreds of miles in competitions. The most famous competition is the nearly 1,000-mile

Alaskan Iditarod. Iditarod dogs are commonly given opioid painkillers to allow for the completion of the debilitating journey. In 2016, traces of the painkiller tramadol were found in four of the Iditarod's winning dogs. Race officials were unable to prove intentional drugging, and the musher was permitted to maintain his title and keep his $59,000 in winnings. (The musher claimed that his dogs were drugged by someone seeking to sabotage his impending win.)[19] The pain medications "enhance" the dogs' capacity to run through pain, otherwise an indication that they ought to stop racing. This incident spurred some commentators to raise and explore concerns about "gene doping" in a podcast about sled dog racing that aired in late 2017.[20]

The Next Frontier: Genetic Animal Enhancement

Theoretically, genetic engineering using CRISPR will serve the same purposes as traditional breeding, but with greater efficiency when it comes to producing offspring with desired traits. Unlike chemical enhancement, enhancements to musculature, recovery time, pain tolerance, lung capacity, or any other genetically enhanceable trait will be permanent, not merely enduring for the duration of a race. This could affect how animals are trained, too. Manipulating the genomes of sport animals to carry the genetic basis for desirable traits would ideally eliminate the possibility of unwanted genetically "inferior" offspring, and so reduce the number of animals that are discarded because they do not exhibit desirable traits. If successful, new forms of genetic engineering might be more ethical in the sense that they would decrease the number of sacrificed animal lives. But this success will be mediated by two key complications. First, the technical accuracy of genetic modification is far from proven. The CRISPR editing system often modifies genes in unintended locations, or incompletely modifies the intended genes, though uncertainty remains about the prevalence of such mutations.[21] The outcome could thus be an animal without the intended genetic predispositions, or an animal with the intended predispositions but with other health or physical complications that would undermine its sport abilities. Second, the genetic foundation for many if not most beneficial sport traits—such as intelligence, speed, and aggression—are significantly determined by environment and by multiple genes, which means that despite claims from companies like Thoroughbred Genetics Limited, identifying and modifying the right genetic sequences to achieve these traits will be difficult. A genetic study of racing pigeons failed to identify single genes responsible for racing success and suggested a polygenic basis for the racing birds' abilities.[22] Either of these complications will cause the birth of many animals without desired sport abilities, which significantly undermines the argument that genetic engineering will be more efficient and thus more ethical than traditional breeding.

These technical limitations and health concerns are not stopping scientists and breeders from pursuing genetic enhancement. Just as in horses, there is considerable interest among sled dog racers in figuring out the genetic underpinnings of sled dog endurance.[23] Genetically edited dogs have been created in labs.[24] Perhaps the most relevant examples were beagles that were bred to "turn off" the myostatin gene. Myostatin stops new muscle from being made and causes the atrophy of muscles no longer in use. It is thought to be implicated in muscular dystrophy, hence its relevance to biomedical researchers. Beagles bred with the mutation are far more muscular than nonedited counterparts, setting off interest in targeting

the myostatin gene for "doping" in both human and nonhuman animals. Outside of the lab, self-described "biohackers" are reported to be making headway in using CRISPR to edit dog embryos in their homes and barns.[25]

A commentator on dog sled racing said in late 2017 about gene doping of sled dogs, "I don't think we'll see it, it will just happen."[26] This sentiment is shared by a biohacker who has said, "I'd be very surprised if there isn't somebody out there doing it [gene doping] already. It's so hard to test for. What are you going to do, look for DNA?"[27] Gene doping is already explicitly against the rules set by the International Federation of Sleddog Sport. Enforcing this rule today would be nearly impossible because the tools to prove that a dog embryo was modified using CRISPR do not yet exist, short of the editor admitting doing so. Horses, dogs, bulls, and many other sport animals will likely be edited without any public knowledge or discourse.

Ethical Animal Use in Sport

Our key question in this paper is whether gene editing can be ethically incorporated into breeding sport animals. But a prior question is whether animals can ever be used ethically in sports. We said above that our welfarist analysis of ethical animal use will depend on two questions: (1) Does participation in sport advance, violate, or otherwise thwart animals' interests? (2) Does the advancement of humans' interests through the use of animals in sport justify the use of animals in ways that violate their interests and override their rights? In this section we take an in-depth look at the first question by assessing the extent to which animals interests—and so rights—are thwarted by their use in sports. We then go on to argue that animals' assent, or at least absence of dissent, is a necessary condition of ethical animal use in sport. This is because seeking assent and respecting dissent amount to respecting an animal's interests. These considerations are meant to guide ethical analysis of animal use in sport, not to render a universal verdict on the practice. Whether or not a particular use of sport animals meets these standards will depend on the specifics of the case.

We are going to bracket for the purposes of this paper an in-depth analysis of the human interests that are advanced by the use of animals in sport, for two reasons. First, we should be clear on how animals' interests are affected by sport participation and what it means to respect animals' rights. This is the focus of the current section. Second, the human interests advanced by animal use will vary substantially by sport.

Animals' Interests and Sport Participation

As discussed above, we think it is uncontroversial to assume that animals have interests. In virtue of having interests, animals have certain rights that correlate with a duty on all moral agents to take seriously their interests and respect their rights. The more a sport advances animals' interests, or the less it disrespects their interests, the more ethical the use of animals in that sport. This view admits of a continuum, then, between sports that are completely contrary to animals' interests, such as blood sport fighting, to sports that respect and maybe even advance animals' interests, such as, possibly, disc dog. The more a sport treats an animal as a creature with its own morally relevant interests and rights—whether competitor, cooperator, or teammate—the more ethical it is.

Even the most clear-cut cases of ethical sport animal participation require deeper examination. Disc dog tournaments, which involve various forms of trick and distance Frisbee catching, most often demonstrate all necessary signs of ethical animal sport: dogs have their own interests in performing species-typical behavior like running, jumping, and retrieving, which are respected and advanced by their strongly bonded human coparticipants. We can speculate that dogs derive pleasure from participating in Frisbee catching, as any dog owner who plays fetch can attest. Many dogs actively seek out the activity. But even this sport could become grueling, overexerting the dog in training or competition to the point of exhaustion, for a trophy or financial benefit in which the dog might not share.

One might defend the practice on the basis that animals have an interest in sport participation. After all, the behaviors that sport animals perform are all "natural" behaviors. Horses run and jump, roosters and many other animals fight or kill each other, Labradors retrieve, etc. One might ask: how could it *not* be in the interest of the animal to perform species-typical behaviors that evolved to promote their survival and reproductive fitness? Although we grant that many sport animals are participating in natural behaviors that they would likely exhibit even outside of the sport arena, there is nothing natural about the contrived scenario in which they are expected, and sometimes forced, to perform. Horses run, but as far as we can tell, they do not set up competitive races among themselves. Roosters and many other animals fight or kill each other for mating privileges and survival, but they do not use spears attached to their feet to enact even more violence. Animals hunt each other for survival in nature, but that does not mean that we should hunt or fight them for sport. Hunting and fighting in nature happens out of necessity for survival and preservation of social structure, not for its own sake. Natural behaviors also do not imply acceptability of overcommitting animals to sports. Just because horses are powerful runners and run in the wild does not imply that they can be required to race-train 40 hours per week or run in five races per day.

YouTube provides overwhelming evidence that many animals engage in play with each other, both within and across species, for its own sake (i.e., not as a means to survival or reproduction).[28] But this does not establish an interest in competition or an understanding of what it means to win or to lose. In sum, animals have an interest in performing some of the behaviors they do in sports, but that does not prove that they have an interest in participating in sports in the way humans have constructed sports, primarily with their own human interests in mind.

Further, there are many ways in which sport participation goes against an animal's interests. Animals have an interest in avoiding pain and distress, but participation in sport can be very painful, especially when animals become injured during training and competition or are forced to overexert themselves during training or competition. Chemical enhancement also goes against animals' interests. It is dangerous, often leading to overexertion, poisoning, pain, and sometimes death.

When considering whether sport participation respects an animal's interests, we should also consider the ways in which animals are housed, fed, and trained, all of which affect animal welfare. One argument often used to defend animal use in sports is that animals used for sports are often housed and fed better than animals that are not used in sports.[29] Because sport animals are also financial investments, owners, trainers, and riders have an incentive (beyond animal welfare) to treat the

animal very well and keep them in peak health. This is true of successful animals but not of unsuccessful animals, which are killed or slaughtered when they are no longer of value to the owner. Furthermore, to the extent that horses that compete in horse racing enjoy nicer living conditions than horses that do not, this is motivated by financial gain, not the horses' well-being. It further commodifies the animal, reiterating the fact that the horse—or any other income-producing animal—is not respected as a creature with its own interests, but rather as a thing that advances human interests.

Animal Assent and Dissent

Ethical human participation in sport is generally premised upon consent to participate. Unlike when slaves or prisoners were forced into gladiatorial competitions in ancient Rome, today's human athletes choose to participate in sports with an understanding of the risks and benefits. Consent requires knowledge of how the game is played, the capacity to understand the rules of the game as well as the potential risks, freedom from undue influence, and the ability to express willingness to participate. We will assume that animals are not capable of consenting to sport participation in the same way that human adults consent to sport participation. Still, ethical animal participation in sport, we argue, should obtain the animals' assent, and, if that cannot be obtained, respect animals' dissent.

A similar claim has been made in the context of animal use in research. Rebecca Walker, for example, has asked, "Are animals capable of assenting to or dissenting from research?"[30] She answers:

> From a commonsense point of view, it seems that at least some sorts of animals have the capacity to assent to and dissent from certain activities. When a pet dog stands at the door waiting to go outside at the usual time she is taken on a walk, she is assenting to being taken for a walk. When she squirms away at the placement of a leash she is dissenting to the particular form that the walk will take. If animals have some understanding of what is involved in the activity and if the assent or dissent is not based on training that is highly coercive in nature, they may voluntarily engage in or reject the activity.[31]

Similar assent and dissent behaviors happen in the context of sport participation. For example, race horses know to wait behind the gate until it opens, agility dogs know the proper order of obstacles on a course for which they are trained. Hurt roosters in cockfights cower in the corner of a cage, and often must be forced back into the ring to fight to their death.

We cannot know to what extent animal behaviors are intentionally chosen or instead performed without agential awareness, ingrained instead by instinct or training. Horses run in the wild and sometimes play with each other, but that does not entail that they self-reflexively choose to do so. Since many of these behaviors are the result of rigorous and coercive training, we cannot know whether the animal is conditioned to go along with the behavior or is seeking it out.

The fact that an animal's behavior occurs in the wild is a natural starting point for identifying animal assent to an activity (although not sufficient alone). Sheepdogs are natural herders and often attempt to round up groups of animals (human and nonhuman) regardless of the setting. This might be a useful indication that such

dogs would be more likely to seek herding behaviors, and as such, assent to participate in herding competitions. However, it does not mean that all dogs, or even all dogs within a specific breed, should participate. It also does not imply that animals have an interest in participating in sports in the ways that humans have constructed them.

It is most informative to look to an animal's seeking of behaviors and willingness to participate as indication of assent. Does the animal actively seek out the activity, even when outside the field or arena? When participating, does the animal exhibit signs of enjoyment such as tail wagging, positive vocalizations, or preparation to repeat play? An animal's expression of willingness can help indicate both knowledge of the rules and freedom from undue influence and can justify the inference that they assent to play.

The opposite of assent is dissent. And just as we might ascertain assent to participation by closely watching animals for indications of seeking out the behavior and performing in accordance with what is expected of them, if not exhibiting a desire to play, animal owners, handlers, and trainers should be responsive to indications of not wanting to play. Even if one does not agree with us that some animals assent to sport participation, it seems undeniable that animals nonetheless can dissent from participation. Andrew Fenton says that dissent involves three capacities: (1) the capacity for distress, pain, or stress; (2) the capacity to anticipate the future occurrence of distress, pain, or stress; and (3) the capacity to "ask" that it stop or to express that the relevant distress, pain, or stress is unwanted.[32] "Asking" here can refer to cowering, refusing touch, kicking, bucking, or any other behavior that indicates and communicates unwillingness to "go along with" sport participation.

Respecting dissent is required as part of treating the animal as an independent creature with interests and rights that will sometimes conflict with the owner's interests. Owners, breeders, trainers, and riders should seek assent where possible, and respect dissent if the animal is reticent or resists sport participation, whether in training or in competition, unless overriding dissent can be justified by important competing interests.

Analysis of Gene Editing in Sport Animals

Assuming genetic editing technology becomes more accurate and scientists or biohackers can identify genetic sequences that significantly contribute to desirable sport traits, it might be feasible to design sport animals that far outstrip the capacities of animals bred through traditional methods. We can imagine genetically engineering a husky to have twice the capacity to utilize oxygen during intense exercise, thus making it possible to run through snow and wind while pulling a sled for multiple days without rest. We can imagine an extra muscular animal that runs faster or fights harder. We could also imagine breeding a betta fish to have quicker reaction times to improve its ability to dodge attacks and deliver fatal blows during fish fights.

In the short term, if these animals with superior abilities compete against traditionally bred animals, they will win, that might mean longer and better-quality lives for the winners. But animals that lose are often discarded, abandoned, or killed. The result of this rise in genetically edited animals would first mean significant harm to the many losing animal opponents. Before we even consider the effect of gene editing on edited animals, it seems that gene editing is not in the interest

of extant non–genetically edited animals, who will be made obsolete by the rise of a new class of sport participant. In the longer term, it is likely that successful genetic editing will lead to a "sport arms race," because the technology will be sought and accessed by most owners, breeders, and trainers, which might re-level animal sport outcomes or lead to the creation of a separate competition bracket for genetically engineered animals.

Successful genetic engineering might encourage unrealistic expectations of sport animals, thereby promoting the slide toward using animals as mere things to be discarded, rather than creatures with their own interests and rights. Responsible owners or trainers should pay careful attention to the health and limits of their sport animals by recognizing signs of fatigue, discomfort, displeasure, or dissent. Primary attention should be given to the specific physical and verbal expressions of the animal to determine when assent to sport participation is revoked. But because of the limitations of animal-human communication, owners, trainers, and veterinarians have until now looked to the historical capacities of the breed. How long can a camel safely run without stopping to catch breath or hydrate? How many rolls can most roller pigeons safely perform while airborne before becoming dizzy and disoriented? Ideally, these kinds of questions inform the distances and other quantifiable objectives of specific animal sport events. Genetically engineering animals might cause a shift in the ability range of a particular species far beyond that seen in traditional breeding, even possibly creating new species in a single generation. Without species benchmarks for ability range, and given that a sport animal is genetically engineered to be superior in specific respects, it is easy to imagine a trainer pushing their sport animals well beyond safe limits as they find a "new normal" for genetically enhanced animals.

Breeders and stewards of sport animals should accept the possibility that a given animal might not have the ability or preference to compete, or that the animal might revoke assent at any point during its competitive career. In the current breeding environment, the uncontrollable genetic lottery might be one aspect that preserves realistic expectations, allowing humans to accept that an animal is either not cut out for sport, or is done with sport. These expectations comport with respecting the animal's interests and rights. Pursuing the promises of genetic engineering to achieve specific desirable sport traits could further objectify sport animals as mere equipment for achieving greater speed, strength, or other strategic edge, which could lead to a less ethical sport animal environment.

We must also consider the possibility that genetic engineering could be used for the specific purposes of improving the welfare of sport animals. One potential application might be modifying an animal to have superior communication skills, perhaps by modifying genetic pathways for intelligence and physical structures that lead to verbalization. It might be possible to genetically engineer an animal to have genuine capacity for consent to sport participation, not just assent, in which case we would have to admit that with new capacities, the animals would have new interests—and new rights on par with humans' rights. If this were possible, we would have far more complicated decisions to make than sport participation, such as the animal's rights to health care, education, and employment. But because of the risks inherent in sport as well as potential benefits, the closer that we can get to achieving animal consent to participation, the greater the likelihood that animal involvement—with consent—is ethical.

Most potential avenues to improving the welfare of an animal through genetic engineering are double-edged. For example, genetically engineering an animal to feel less pain, hunger, or thirst appears to have the animal's benefit in mind. Pain, hunger, and thirst are all sources of discomfort; so reducing them would improve quality of life. Some people have defended genetically modifying industrially farmed animals on this basis.[33] However, each of these is also an indicator of threats to health, which if removed, would make it more difficult for an owner or trainer to know when the sport animal is in jeopardy. The more likely outcome would be that such modifications would lead to pushing the animal harder, thus causing greater risk of injury or death. Perhaps modifying actual thresholds, such as greater body-structural integrity that would make pain-causing injury less likely. Increasing metabolism efficiency to exercise longer with less nutrition would be a more genuine welfare enhancement. But to improve the state of these engineered animals, we would have to maintain existing parameters of competition so that the animals actually experience the benefits of their enhancements. Because of the exhibitionist nature of many animal sports (i.e., the excitement of seeing faster and stronger performance), and the extrinsic motivations of animal sports (i.e., the financial gain from winning), it is highly unlikely that breeders or trainers would undertake such modifications without intentions to push the animal to the new limit. Accordingly, if such modifications were technically feasible and safe, they might be accompanied by new regulations to preserve existing standards for safe sport practice and participation.

Conclusion

Although gene editing could be used, in principle, to either enhance the capacities and rights of animal participants in sport or diminish capacities such that they no longer feel pain or discomfort from rigorous training, we think it is unlikely that gene editing will be used in ways that, in practice, protect and respect animals' interests. Already, animals are treated as mere objects—commodities to be traded, bred, and drugged whatever the effect on the animals' welfare and well-being—and instrumentally valued for the profits produced. Why should we think that gene editing would be taken up any differently? There are ways to use animals ethically in the name of sport competitions, by protecting their interests, seeking assent, and respecting dissent. Gene editing, we think, is unlikely to encourage these ethical behaviors and relationships, and to the contrary, will likely discourage them. If gene editing were incorporated into animal breeding, we would hope that animal protections are simultaneously strengthened to prevent abuse.

Notes

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