Green Light: Toward an Art of Evolution

George Gessert

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1 Divine Plants and Magical Animals

It began as a joke. In 1910 three paintings made by a donkey were exhibited at the Salon des Indépendánts, in Paris. Roland Dorgelès, a Parisian journalist, had tied a brush to the donkey's tail and positioned canvases to receive swatches of bright, fauvist color. The donkey, who was named Lolo, belonged to the proprietor of a café in Montmartre where Picasso and his friends gathered.[1] News of the prank spread among the avant-garde and inspired the radical wing of the Russian cubo-futurists to name their group "Donkey's Tail." The group included Kazimir Malevich, Marc Chagall, and Natalia Goncharova. Donkey's Tail disbanded in 1913, one year after it formed, but the idea that nonhumans could play a role in art was not forgotten.

The first major exhibition of living things as art was *Edward Steichen's Delphiniums*, an installation of cut delphiniums on view at the Museum of Modern Art from June 24 to July 1, 1936. Steichen had bred the plants at his farm in West Redding, Connecticut, where he also hybridized cleomes, sunflowers, and poppies. The show received a somewhat cool reception from many within the museum but was widely and enthusiastically reported in the press. Steichen believed that the event confirmed plant breeding as a fine art.[2]

Two years later, at the International Surrealist Exposition in Paris, Salvador Dalí exhibited *The Rainy Taxi (Mannequin Rotting in a Taxi-Cab)*, which consisted of the shell of a taxi containing two mannequins nestled amid live ferns. Snails crawled about the interior, which was bathed in mist from a sprinkler system installed in the taxi's ceiling.

Rainy Taxi and *Edward Steichen's Delphiniums* had nothing in common except that both were installations and both contained live materials. Diverse approaches have distinguished bio art ever since. Bio art, which is art composed of living things or created in conjunction with them, is less a movement than a constellation of allied media, each consisting of a species or a breeding complex. The Second World War interrupted the exploration of the use of live materials in art, but work resumed in the 1950s. Since then artists have experimented with a wide range of life forms, first in the United States and Western Europe, then in Canada, Russia, the Balkans, Australia, Japan, and China.

Among the life forms that have been exhibited as art are grasses—wild, domesticated, and genetically engineered—and numerous species of trees, several kinds of bacteria, various fungi, slime molds, and aquatic creatures, including fish, frogs, and fluorescing tadpoles. Crabs have made their way into art, along with caddis fly larvae, algae, horses, honeybees, pigeons, plant seeds and bedding plants, ants, protozoa, spiders, earthworms, maggots, caterpillars and butterflies, vanda orchids, interspecific iris hybrids, elephants, dogs, chickens, silkworms, culinary herbs, turtles, mice, scorpions, and several species of spiders. (Additional organisms and a list of representative works can be found in appendix 1.)

Not all works of bio art involve entire organisms. Installations have been made with pollen, plant cuttings and calluses, and cells and cell lines from lilies, goldfish, pigs, rats, and prenatal sheep. One installation contained a hybridoma consisting of a human white blood cell fused with a cancer cell from a mouse.

Specializations have emerged. Biotech art is bio art in which the living components have been biotechnologically altered. Jens Hauser, who brought the term into use among artists, defines biotech art broadly to include life forms modified by technologies ranging from those used in traditional plant and animal breeding to genetic engineering.

Transgenic art is a subset of biotech art in which living components have been genetically engineered.[3] (For a summary of these and other key terms, see appendix 2.)

Articles and books about bio art, biotech art, and transgenic art have emerged in a steady stream over the past decade. Recent writings have dealt largely with biotech art's relationship to science and biotechnology and with political, ethical, and social issues. For example, *Tactical Biopolitics*, a 2008 compilation edited by Beatriz da Costa and Kavita Philip, engages such issues as eugenics, the corporate appropriation of biotech art through art exhibits, and how biotech art can affect understandings of race, gender, and the human-made environment.[4]

Pier Luigi Capucci and a few others have addressed philosophical, aesthetic, and art historical issues, but little sustained work has been done in these areas. Jens Hauser is the exception, but even he acknowledges that "art that uses biotechnology as its means of expression is currently addressed less as art and more as . . . [a contributor to] public debates beyond the aesthetic realm."[5]

In addition to the absence of commentary on aesthetics, writings have largely ignored how bio art can affect our understanding of plants, animals, evolution, and nature. Helen and Newton Harrison and others have addressed ecological issues, Eduardo Kac has written about the social matrixes that genetically engineered organisms belong to,[6] and Ionat Zurr has looked at the phenomenon of cell lines surviving and mutating in vitro to become what amount to new species.[7] Much more discussion is needed. In bio art, cultural histories meet the histories of organisms, and in these encounters bio art's most far-reaching meanings can be found.

As art materials, organisms can be divided into two broad categories, sentient and nonsentient. To the best of our knowledge, sentience, or the capacity for feeling or for consciousness, occurs only in creatures with nervous systems: animals. To ignore the suffering of animals, or to explain it away, as Descartes attempted to do when he described the cries of animals as grinding gears, is not an option for artists today. No one knows exactly what any other creature experiences, but we have compelling reason to believe that virtually all vertebrates feel pleasure and pain. As for invertebrates, there is no consensus about exactly where sentience begins or is of sufficient order to raise the kinds of ethical questions that apply to vertebrates. Octopuses, which are mollusks, respond to the world in ways that may be as complex as fishes' or birds' responses.

In 1930 the writer Olaf Stapledon foresaw dangers in breeding animals as art. He envisioned a future society in which artists deliberately created monsters to express cruelty and hatred of life. However, we do not have to look to the future for deeply disturbing possibilities. Hermann Nitsch commissioned the slaughter of animals in *Orgien Mysterien Theater,* and Newton Harrison electrocuted fish in *Portable Fish Farm*. Ana Mendieta decapitated chickens, Kim Jones set fire to rats, and Mark Pauline tossed pigeons into a shredder.[8]

The roots of art very likely reach into animal sacrifice. Hopefully cultural conditions will not require additional exploration of those particular roots, but this may be whistling in the dark at a time when transgression in art is routine and human-caused mass extinction is unfolding. It is all too easy to imagine circumstances that might lend legitimacy to appalling forms of expression that involve animals.

The best line of defense against cruel, ignorant, or frivolous mistreatment of animals in art is recognition that our experience of bio art is not fundamentally different from that of work done in traditional media. In all cases *every* aspect of a work contributes to the experience of it, whatever the artist's intentions. Materials are central. They inflect the meanings they carry and tend to have the last word. As a result empathy and aesthetics, without becoming identical, strongly overlap in bio art. When an animal is part of a work, whatever the creature experiences becomes part of that work and its meaning.

Of course, many aspects of an animal's experience may not be immediately apparent, or may never be known. For example, Joseph Beuys's 1974 performance, *Coyote*: *I Like America and America Likes Me* (figure 1.1), in which the artist shared part of a Manhattan gallery with a coyote for one week, must at times have caused the animal considerable distress. It had been brought from upstate New York to the René Block Gallery. There the coyote had to endure close proximity to Beuys, who part of the time was engaged in shamanistic rituals, some of which involved sudden movements or blasts of sound.[9] Visitors came and went. There is no evidence, however, that Beuys or anyone else connected with the action was aware that the animal might have suffered because of the performance.

Figure 1.1
Coyote: I Like America and America Likes Me. Installation by Joesph Beuys, 1974.
Photograph copyright Caroline Tisdall. Courtesy Ronald Feldman Fine Arts, New York (www.feldmangallery.com).

Certainly Beuys did not want the animal to suffer, and no doubt much of the time it did not. He was the coyote's jailor but assumed the role of a shepherd-like protector. He also went to great lengths to honor the animal's cultural significance. In a statement about the action Beuys emphasized the coyote's psychological significance, its symbolic and mythic qualities. "I would never have done it with a coyote in Europe. . . . I believe I made contact with the psychological trauma point of the United States' energy constellation: the whole American trauma with the Indian."[10] However, the animal's symbolism and its evocation of Native American trickster stories, along with its startling novelty in the context of art, seem to have obscured much of its flesh-and-blood reality for Beuys, and probably for viewers of the performance as well. Today, with live art more common and sensitivity to the needs of animals more widespread than in the 1970s, many people would probably see the coyote as first and foremost an individual sentient being, a captive, probably bored and at times under considerable stress. Photographs of the performance show the animal panting, attacking Beuys's cane and felt, resting, and apparently pacing, sometimes with ears held back.[11]

Beuys wrote that his intent was to "remind the coyote of what you could call the geniality of his particular species . . . and that we need him as an important cooperator in the production of freedom."[12] This is noble but arrogant wishful thinking. Coyotes do not need to be reminded of their coyote nature. I live in the Oregon countryside, where wild animals, including coyotes, are common. With care and patience, one can intermittently make contact with some wild animals, such as deer and turkeys, and share moments of mutual awareness. Even under the best circumstances this takes much longer than one week. Coyotes, however, carefully avoid people, at least in my area. What Beuys did was force the animal to endure prolonged contact with humans in an environment utterly alien to it.

In Beuys's defense, he proceeded as any artist must who takes up a new medium: he could bring to bear only those habits of mind acquired from previous experience with other media. From the evidence of his statements and what we know about the action, he understood the coyote primarily as a signifier, one that happened to be alive but functioned less as a sentient being than as the representation of one, a representation overlaid, perhaps, with memories of domesticated animals and with transcriptions of Native American stories. Beuys saw Coyote, not a coyote. Consequently, photographic documentation of the action may be truer to Beuys's intentions than was the action itself.

Every new medium involves the risk of slippages and misunderstandings, but these are more immediately consequential with animals than with nonliving materials, or with nonsentient living ones. We can only guess what the coyote experienced, but from the perspective of art the trick was on Beuys, the trickster. By forcing himself on the coyote, he fell into an old trap and reenacted in miniature the exploitation of wild nature that Europeans brought to the Americas. At the same time he created a work that embodies dreams of healing the ancient divide between human and nonhuman.

As we direct our attention to the plants and animals that have been affected by human consciousness, it is wise to keep Coyote of Native American legends in mind. Coyote expresses a view of the world in which primal energy is more creaturely than human, and only partly quickened with socialized consciousness. In the world according to Coyote, creativity is often capricious, and always has unintended consequences. Unlike the Judeo-Christian God, who teaches human exceptionalism and commands faith, Coyote teaches laugher, self-acceptance, and alertness in an order in which plants, animals, and the land take precedence. This view can be extremely dark. We have a place in the world, but cannot hope to maintain it for long without awareness that it was not made for us.

Different life forms raise different ethical issues. If Beuys's action were reconstructed and the coyote replaced by a bonsaied redwood tree, the project would not raise the same ethical objections.[13] Plants cannot suffer, and therefore they can be manipulated in ways that would be unethical with animals. With plants, few experiments are auto-

matically off-limits except those that might damage the environment or cause sentient creatures unnecessary pain. Somewhat like paint and clay, plants, along with bacteria, fungi, and tissues grown in vitro, permit artists to make mistakes, including ones fatal to the organism. Plants may even allow the artist to be cavalier or perverse, which we must sometimes be as we explore the role of human consciousness in evolution.

Of course, to kill a plant is to eliminate a living being with a unique set of possibilities. To kill a plant involves assuming responsibility. As Donna Haraway puts it in a slightly different context, "this is . . . the beginning of serious accountability inside worldly complexities." Killing plants is permissible, but casual, willfully unaware killing is not.[14]

A distinguishing feature of bio art is that, because its materials are alive, they are our kin. To recognize another as kin is to see oneself in the other. Our kinship with vertebrates is obvious, because their bodies are organized much like our own. Their tempos resemble ours, and most of us sense something of their capacity for pleasure, pain, and responsiveness. But how are we to recognize ourselves in plants? Although we have affinities at the subcellular level, in the context of art, to define kinship in terms of proteins and base pairs does not invite more than limited identification.

Plants have no nervous systems and to the best of our knowledge interact with the world entirely without consciousness. This does not make them absolutely different from us—far from it. We have within ourselves something of their way of being. What we share, I believe, is not any particular experience of life but something fully as important: the nonexperience of life.

The extent to which we do not and cannot experience life is something that I began to understand only after the first time I had surgery. I was twenty-two. Skateboarding down a hill in San Francisco, I fell and fractured my ankle. At a hospital, sodium thiopental eliminated not only every trace of pain but also dreams and the perception of time. The instant that I went under the drug, I awoke—six hours later. In that interlude existence ceased, yet I continued to breathe and metabolize, my blood circulated. A surgeon drilled through my bones, adding wires and screws to my ankle, without causing me the least discomfort.

The nonexperience induced by total anesthesia was how I first learned for myself that life is not synonymous with consciousness (which includes dreams and apprehension of nothingness). What is the experience of a pancreas? A mitochondrion? Most of us are quite happy never to know. Our lives drift on a sea of eternal unconsciousness far deeper than anything that Freud or the surrealists charted. Not even the most shadowy intuitions materialize in the depths of that ocean. It is a realm permanently without awareness, and yet it is here that the intricate structures and processes that make up the support system of consciousness are generated.

When we ignore the realms beyond consciousness, we ignore our connections to the larger community of living beings, most of which, over immense spans of time, have lived and died without once awakening. Plants are reminders of the structures that sustain consciousness. Plants are reminders of our forgotten selves.

Human aesthetic preferences have affected other organisms at least as far back as the emergence of domesticated plants, more than 10,000 years ago. Arguably we could push back farther, to times when we were not yet human and many of our aesthetic predispositions first emerged. We could attempt to identify which of our perceptions we share with other mammals, or even insects. For example, many creatures respond to bright yellows and reds. These are warning colors, commonly displayed on wasps, reptiles, and poisonous spiders. Did we begin to single out yellow and red when we were lemur-like? Amphibian? But here our subject, the intersection of art and living things, loses focus. Better to begin this investigation with the role of aesthetic preferences in domestication.

Domestication occurs when two species evolve mutually beneficial (although not necessarily equal) relationships, and at least one of the partners can no longer best complete its life cycle except in association with the other. The phenomenon may emerge slowly, over a great many generations, or may be swift. Plants can leap into domestication in a single generation, which happens fairly often through elimination of reproductive barriers in cultivation. For example, in the wild, *Iris douglasiana*, a clump-forming species of Pacifica iris that grows along the coasts of Oregon and California, never crosses with *Iris munzii*, a tall, broad-leaved and large-flowered species endemic to a small area in the southern foothills of the Sierra Nevada. The ranges of the two species do not overlap. However, the species are reproductively compatible and will hybridize in gardens. New and sometimes very attractive hybrids result, ones that exist only in association with humans. These hybrids are fertile but cannot survive without cultivation. They are domesticates.

Domestication of this sort is not always a result of cross-pollination by humans. Cross-pollination in gardens is often carried out by insects. There is nothing necessarily deliberate or conscious about the emergence of new domesticates.

Domestication usually involves genetic change, but not always. When a species becomes extinct in the wild but persists and spreads in cultivation, it becomes domesticated without genetic change. Franklinia (*Franklinia alatamaha)* is an example. It is a handsome shrub or small tree with camellia-like flowers. At one time it grew in the Altamaha River valley in Georgia, where botanists first identified it in the 1760s. During the next decade American botanist William Bartram collected its seeds, which he grew in Philadelphia. Franklinia was last recorded in the wild in 1803. Since then many searches have failed to find wild-growing plants. Fire, floods, and introduced disease

probably eliminated wild populations, but over the past two centuries Franklinia has become widespread in cultivation. All existing plants are descended from the seeds that Bartram collected.

Domestication is not something that only humans accomplish. Approximately forty species of leafcutter ants in two different genera cultivate fungi. The ants harvest leaves and bring them underground to serve as substrates for the fungi. Like human farmers, the ants kill pests and weed out competing organisms. Different species of leafcutter ants cultivate different fungi, which in most cases are not known to exist independently of the insect. This form of domestication probably first evolved tens of millions of years ago, which means that ant fungi have been domesticated hundreds or thousands of times longer than dogs, the oldest human domesticate. The association between ants and fungi has made leafcutter ants among the most successful insects in the New World tropics.

Termites, wood wasps, and ambrosia beetles also cultivate fungi for food. Other species of ants live in the enlarged, hollow thorns of acacias. The ants protect their home acacias from predators and eliminate competing vegetation. Pure stands of acacias result. The acacias supply the ants with sugary exudates and modified, nutritious leaf tips called Beltran bodies. If an acacia loses its ants, the plant usually becomes overrun with predators and dies.

Archaeological evidence indicates that plants domesticated by humans existed at least 10,000 years ago, although the actual beginnings of domestication may go back much farther.[15] Contrary to popular belief, humans almost certainly did not domesticate plants and animals only to alleviate hunger. Hungry people would not have had the time or energy to undertake long-term, uncertain experiments in selection. Critical early stages of domestication probably unfolded among people who were well-fed.[16]

Some early stages of domestication may have been impelled by aesthetics, compassion, and belief in magic. Carl Sauer, a geographer who has studied the origins of domesticated plants and animals, believes that hunter-gatherer women commonly kept baby animals that had been found in the wild or orphaned as a result of hunting.[17] Young animals arouse curiosity, delight, and compassion. At some point, certain of our Paleolithic forebears moved from caring for immature animals to keeping them into adulthood and allowing them to reproduce. Reproduction in association with humans is a crucial step toward domestication.

Other organisms may have been deliberately selected for use in religious ceremonies or for producing magical substances. Sauer draws particular attention to turmeric, a tropical plant in the ginger family. Turmeric grows only in association with humans. Its origins are unknown, although Southeast Asia may have been its original home. Sauer suggests that turmeric was domesticated in the remote past to provide coloring for bodies, clothing, and food. Its use as a spice came later. In southern Asia many

people still believe that turmeric has the power to enhance fertility. This power is associated with its rich golden color, the color of the sun.[18]

Color may have played a role in the domestication of animals as well. The first domesticated chickens may have been rare variants with black skin and bones that were used in magic. Raising chickens for eggs and meat came later.[19]

Whether or not Sauer is right about the earliest domesticates, recent domestications follow the pattern that he describes. Almost all domestications in the last 500 years have been accomplished by economically secure individuals or groups directing evolution out of curiosity or in search of luxuries or aesthetic pleasure—especially aesthetic pleasure. Of the hundreds of species domesticated in the last half millennium, the overwhelming majority are ornamental plants. So many species of ornamentals have been domesticated that they now outnumber all other domesticates combined. We will look at this phenomenon in chapter 3, but first a quick survey of other domesticated organisms is in order.

Animals that have been domesticated in recent times include minks, chinchillas, and foxes, whose furs are used to announce social status and display wealth—hardly basic necessities. Roughly a score of species have been domesticated as fanciers' animals, kept primarily for their aesthetic qualities. Among these animals are guppies, tetras, swordtails, angelfish, and canaries. Some of these also serve as pets. Other species domesticated as pets in the last few centuries include gerbils, mice, parakeets, cockatiels, skunks, and several species of parrots.

Scientists have domesticated a number of species for use in laboratories. These organisms might seem to be exceptions to the rule that domestication begins with nonessentials, except that science is often as much an expression of curiosity as of basic needs. Take the little fruit fly, for example. *Drosophila melanogaster* was first experimentally bred in 1901, and immediately proved valuable for genetic research. Thomas Hunt Morgan discovered the first mutant fruit fly in 1910. In the 1920s one of Morgan's students, H. J. Muller, discovered that x-rays cause mutations, and by the 1930s many researchers were using x-rays to induce mutations in fruit flies. After the Second World War, scientists began to use chemical mutagens on fruit flies.

Fruit flies have yielded information about genetics that has revolutionized agriculture, horticulture, animal breeding, and medicine, but pioneer geneticists, even if they envisioned such things, could not have been certain what would actually happen. Initially the science of genetics, along with its tiny, winged workhorse, benefited no one except for a few academics. *Drosophila* geneticists repeated an ancient pattern: when a plant or animal is first domesticated, it benefits only a few people, and they do not survive by eating the organism.

Much the same is true even of recently domesticated food plants. Over the past 500 years, humans have domesticated several dozen species of food plants. Among

these are grapefruits, pecans, blueberries, cranberries, sea buckthorns, strawberries, blue honeysuckles, American elderberries, and muscadine grapes.[20] Some of these plants produce nutritious food and have become economically important. However, before any plant can make a significant contribution to diet, people must modify their eating habits, which are notoriously resistant to change. In the United States the usual path to widespread acceptance of food from a newly domesticated plant is though the food's use as a novelty item, a gourmet indulgence, a flavoring, or a dessert—as a nonessential, in other words.[21]

Newly domesticated oil crop plants such as meadowfoam and jojoba are used mainly for making cosmetics. Deer and elk are well on their way to full domestication to provide culinary diversions for the protein-glutted, not to solve problems of hunger or protein deficiency.

Only a dozen or so species domesticated in the last few centuries have been significantly useful from the start. Among these are several forage plants and the mold *Penicillium chrysogenum* (earlier known as *P. notatum*), which Alexander Fleming first began working with in 1928 and helped to domesticate over the next decade. Almost from the beginning, penicillin saved lives. But these exceptions prove the rule: the overwhelming majority of domestications in the last 500 years have had little or nothing to do with satisfying basic needs.

It is not my intent to give a full account of domestication. However, a few words are in order about how this phenomenon, which appears to have arisen in a spirit blending compassion, aesthetic curiosity, belief in magic, and desire for luxuries, became a necessity for almost our entire species. According to the evolutionary biologist David Rindos, population growth has probably had more to do with determining the contours of domestication than any other single factor.[22] As population grows and food needs increase, the easiest response is usually to produce more food per unit of land. This favors agriculture, ever more intensive. Population growth also favors using and selecting domesticated creatures for food, irrespective of how they became associated with us in the first place and irrespective of long-term social and environmental costs.

In the wake of the agricultural revolution, our omnivorous species, evolved to eat thousands of different kinds of organisms, has become overwhelmingly dependent on just a handful of highly domesticated species: wheat, corn, rice, potatoes, millet, soybeans, common beans, cows, chickens, pigs, and sheep.[23] With industrialization and the commodification of life, dependence has narrowed further, from reliance on a wealth of variability to the consumption of fewer and fewer genetically distinct, patented cultivars.