

Nonmoral Nature by Stephen Jay Gould

When the Right Honorable and Reverend Francis Henry, earl of Bridgewater, died in February, 1829, he left £8,000 to support a series of books “on the power, wisdom and goodness of God, as manifested in the creation.” William Buckland, England’s first official academic geologist and later dean of Westminster, was invited to compose one of the nine Bridgewater Treatises. In it he discussed the most pressing problem of natural theology: if God is benevolent and the creation displays his “power, wisdom and goodness,” then why are we surrounded with pain, suffering, and apparently senseless cruelty in the animal world?

Buckland considered the depredation of “carnivorous races” as the primary challenge to an idealized world where the lion might dwell with the lamb. He resolved the issue to his satisfaction by arguing that carnivores actually increase “the aggregate of animal enjoyment” and “diminish that of pain.” Death, after all, is swift and relatively painless, victims are spared the ravages of decrepitude and senility, and populations do not outrun their food supply to the greater sorrow of all. God knew what he was doing when he made lions. Buckland concluded in hardly concealed rapture:

The appointment of death by the agency of carnivora as the ordinary termination of animal existence, appears therefore in its main results to be a dispensation of benevolence; it deducts much from the aggregate amount of the pain of universal death; it abridges, and almost annihilates,

throughout the brute creation, the misery of disease, and accidental injuries, and lingering decay; and impose such salutary restraint upon excessive increase of numbers, that the supply of food maintains perpetually a due ratio to the demand. The result is, that the surface of the land and depths of the waters are ever crowded with myriads of animated beings, the pleasures of whose life are coextensive with its duration; and which throughout the little day of existence that is allotted to them, fulfill with joy the functions for which they were created.

We may find a certain amusing charm in Buckland’s vision today, but such arguments did begin to address “the problem of evil” for many of Buckland’s contemporaries – how could a benevolent God create such a world of carnage and bloodshed? Yet this argument could not abolish the problem of evil entirely, for nature includes many phenomena far more horrible in our eyes than simple predation. I suspect nothing evokes greater disgust in most of us than slow destruction of a host by an internal parasite – gradual ingestion, bit by bit, from the inside. In no other way can I explain why *Alien*, an uninspired, grade-C, formula horror film, should have won such a following. That single scene of Mr. Alien popping forth as a baby parasite from the body of a human host, was both sickening and stunning. Our nineteenth-century forebears maintained similar feelings. The greatest challenge to their concept of a benevolent deity was not simple predation – but slow

death by parasitic ingestion. The classic case, treated at length by all great naturalists, invoked the so-called ichneumon fly. Buckland had sidestepped the major issue.

The “ichneumon fly,” which provoked such concern among natural theologians, was actually a composite creature representing the habits of an enormous tribe. The ichneumonoidea are a group of wasps, not flies, that include more species than all the vertebrates combined (wasp, with ants and bees, constitute the order Hymenoptera; flies, with their two wings – wasps have four – form the order Diptera). In addition, many non-ichneumonoid wasps of similar habits were often cited for the same grisly details. Thus, the famous story did not merely implicate a single aberrant species (perhaps a perverse leakage from Satan’s realm), but hundreds of thousands – a large chunk of what could only be God’s creation.

The ichneumon, like most wasps, generally live freely as adults but pass their larva life as parasites feeding on the bodies of other animals, almost invariably members of their own phylum, the Arthropoda. The most common victims are caterpillars (butterfly and moth larvae), but some ichneumons prefer aphids and other attack spiders. Most host are parasitized as larvae, but some adults are attacked, and many tiny ichneumons inject their brood directly into the eggs of their host.

The free-flying females locate an appropriate host and then convert it into a food factory for their own young. Parasitologists speak of ectoparasitism when the uninvited guest lives on the surface of its host, and

endoparasitism when the parasite dwells within. Among endoparasitic ichneumons, adult females pierce the host with their ovipositor and deposit eggs within. (The ovipositor, a thin tube extending backward from the wasp’s rear end, may be many times as long as the body itself.) Usually, the host is not otherwise inconvenienced for the moment, at least until the eggs hatch and the ichneumon larvae begin their grim work of interior excavation.

Among ectoparasites, however, many females lay their eggs directly upon the host’s body. Since an active host would easily dislodge the egg, the ichneumon mother often simultaneously injects a toxin that paralyzes the caterpillar or other victim. The paralysis may be permanent, and the caterpillar lies, alive but immobile, with the agent of its future destruction secure on its belly. The egg hatches, the helpless caterpillar twitches, the wasp larvae pierces and begins its grisly feast.

Since a dead and decaying caterpillar will do the wasp larvae no good, it eats in a pattern that cannot help but recall, in our inappropriate anthropocentric interpretation, the ancient English penalty for treason – drawing and quartering, with its explicit object of extracting as much torment as possible by keeping the victim alive and sentient. As the king’s executioner drew out and burned his client’s entrails, so does the ichneumon larvae eat fat bodies and digestive organs first, keeping the caterpillar alive by preserving intact the essential heart and central nervous system. Finally, the larvae completes its work and kills its victim, leaving

behind the caterpillar's empty shell. Is it any wonder that ichneumons, not snakes or lions, stood as the paramount challenge to God's benevolence during the heyday of natural theology?

As I read through the nineteenth- and twentieth-century literature on ichneumons, nothing amused me more than the tension between an intellectual knowledge that wasps should not be described in human terms and a literary or emotional inability to avoid the familiar categories of epic and narrative, pain and destruction, victim and vanquisher. We seem to be caught in the mythic structures of our own cultural sagas, quite unable, even in our basic descriptions, to use any other language than the metaphors of battle and conquest. We cannot render this corner of natural history as anything but story, combining the themes of grim horror and fascination and usually ending not so much with pity for the caterpillar as with admiration for the efficiency of the ichneumon.

I detect two basic themes in most epic descriptions: the struggles of prey and the ruthless efficiency of parasites. Although we acknowledge that we may be witnessing little more than automatic instinct or physiological reaction, still we describe the defenses of hosts as though they represented conscious struggles. Thus, aphids kick and caterpillars may wriggle violently as wasps attempt to insert their ovipositors. The pupa of the tortoiseshell butterfly (usually considered an inert creature silently awaiting its conversion from duckling to swan) may contort its abdominal region so sharply that attacking wasps are thrown into the air. The caterpillars

of *Hapalia*, when attacked by the wasp *Apanteles machaeralis*, drop suddenly from their leaves and suspend themselves in air by a silken thread. But the wasp may run down the thread and insert its eggs nonetheless. Some hosts can encapsulate the injected egg with blood cells that aggregate and harden, thus suffocating the parasite.

J. H. Fabre, the great nineteenth-century French entomologist, who remains to this day the preeminently literate natural historian of insects, made a special study of parasitic wasps and wrote with an unabashed anthropocentrism about the struggles of paralyzed victims (see his books *Insect Life* and *The Wonders of Instinct*). He describes some imperfectly paralyzed caterpillars that struggle so violently every time a parasite approaches that the wasp larvae must feed with unusual caution. They attach themselves to a silken strand from the roof of their burrow and descend upon a safe and exposed part of the caterpillar:

The grub is at dinner: head downwards, it is digging into the limp belly of one of the caterpillars. . . . At the least sign of danger in the heap of caterpillars, the larva retreats . . . and climbs back to the ceiling, where the swarming rabble cannot reach it. When peace is restored, it slides down [its silken cord] and returns to table, with its head over the viands and its rear upturned and ready to withdraw in case of need.

In another chapter, he describes the fate of a paralyzed cricket:

One may see the cricket, bitten to the quick, vainly move its antennae and abdominal styles, open and close its empty jaws, and even move a foot, but the larva is safe and searches its vitals with impunity. What an awful nightmare for the paralyzed cricket!

Fabre even learned to feed some paralyzed victims by placing a syrup of sugar and water on their mouthparts – thus showing that they remained alive, sentient, and (by implication) grateful for any palliation of their inevitable fate. If Jesus, immobile and thirsting on the cross, received only vinegar from his tormentors, Fabre at least could make an ending bittersweet.

The second theme, ruthless efficiency of the parasites, leads to the opposite conclusion – grudging admiration for the victors. We learn of their skill in capturing dangerous hosts often many times larger than themselves. Caterpillars may be easy game, but psammocharid wasps prefer spiders. They must insert their ovipositors in a safe and precise spot. Some leave a paralyzed spider in its own burrow. *Planiceps hirsutus*, for example, parasitizes a California trapdoor spider. It searches for spider tubes on sand dunes, then digs into nearby sand to disturb the spider's home and drive it out. When the spider emerges, the wasp attacks, paralyzes its victim, drags it back into its own tube, shuts and fastens the trapdoor, and deposits a single egg upon the spider's abdomen. Other psamunocharids will drag a heavy spider back to a previously prepared cluster of clay or mud cells. Some amputate a spider's legs to make the passage easier. Others fly back over water, skimming a buoyant spider along the surface.

Some wasps must battle with other parasites over a host's body. *Rhyssella curvipes* can detect the larvae of wood wasps deep within alder wood and drill down to a potential victim with its sharply ridged ovipositor. *Pseudorhyssa alpestris*, a related parasite, cannot drill directly into wood since its slender ovipositor bears only rudimentary cutting ridges. It locates the holes made by *Rhyssella*, inserts its ovipositor, and lays an egg on the host (already conveniently paralyzed by *Rhyssella*), right next to the egg deposited by its relative. The two eggs hatch at about the same time, but the larva of *Pseudorhyssa* has a bigger head bearing much larger mandibles. *Pseudorhyssa* seizes the smaller *Rhyssella* larva, destroys it, and proceeds to feast upon a banquet already well prepared.

Other praises for the efficiency of mothers invoke the themes of early, quick, and often. Many ichneumons don't even wait for their hosts to develop into larvae, but parasitize the egg directly (larval wasps may then either drain the egg itself or enter the developing host larva). Others simply move fast. *Apanteles militaris* can deposit up to seventy-two eggs in a single second. Still others are doggedly persistent. *Aphidius gomezi* females produce up to 1,500 eggs and can parasitize as many as 600 aphids in a single working day. In a bizarre twist upon "often," some wasps indulge in polyembryony, a kind of iterated supertwinning. A single egg divides into cells that aggregate into as many as 500 individuals. Since some polyembryonic wasps parasitize caterpillars much larger than themselves and may lay up to six eggs in each, as many as 3,000 larvae may develop within, and feed upon

a single host. These wasps are endoparasites and do not paralyze their victims. The caterpillars writhe back and forth, not (one suspects) from pain, but merely in response to the commotion induced by thousands of wasp larvae feeding within.

Maternal efficiency is often matched by larval aptitude. I have already mentioned the pattern of eating less essential parts first, thus keeping the host alive and fresh to its final and merciful dispatch. After the larva digests every edible morsel of its victim (if only to prevent later fouling of its abode by decaying tissue), it may still use the outer shell of its host. One aphid parasite cuts a hole in the bottom of its victim's shell, glues the skeleton to a leaf by sticky secretions from its salivary gland, and then spins a cocoon to pupate within the aphid's shell.

In using inappropriate anthropocentric language for this romp through the natural history of ichneumons, I have tried to emphasize just why these wasps became a preeminent challenge to natural theology – the antiquated doctrine that attempted to infer God's essence from the products of his creation. I have used twentieth-century examples for the most part, but all themes were known and stressed by the great nineteenth-century natural theologians. How then did they square the habits of these wasps with the goodness of God? How did they extract themselves from this dilemma of their own making?

The strategies were as varied as the practitioners; they shared only the theme of special pleading for an a priori doctrine – our naturalists knew that God's

benevolence was lurking somewhere behind all these tales of apparent horror. Charles Lyell, for example, in the first edition of his epochal *Principles of Geology* (1830-1833), decided that caterpillars posed such a threat to vegetation that any natural checks upon them could only reflect well upon a creating deity, for caterpillars would destroy human agriculture “did not Providence put causes in operation to keep them in due bounds.”

The Reverend William Kirby, rector of Barham, and Britain's foremost entomologist, chose to ignore the plight of caterpillars and focused instead upon the virtue of mother love displayed by wasps in provisioning their young with such care.

The great object of the female is to discover a proper nidus for her eggs. In search of this she is in constant motion. Is the caterpillar of a butterfly or moth the appropriate food for her young? You see her alight upon the plants where they are most usually to be met with, run quickly over them, carefully examining every leaf, and, having found the unfortunate object of her search, insert her sting into its flesh, and there deposit an egg. . . . The active Ichneumon braves every danger, and does not desist until her courage and address have insured subsistence for one of her future progeny.

Kirby found this solicitude all the more remarkable because the female wasp will never see her child and enjoy the pleasures of parenthood. Yet her love compels her to danger nonetheless:

A very large proportion of them are doomed to die before their young come into existence. But in these the passion is

not extinguished. . . . When you witness the solicitude with which they provide for the security and sustenance of their future young, you can scarcely deny to them love for a progeny they are never destined to behold.

Kirby also put in a good word for the marauding larvae, praising them for their forbearance in eating selectively to keep their caterpillar prey alive. Would we all husband our resources with such care!

In this strange and apparently cruel operation one circumstance is truly remarkable. The larva of the Ichneumon, though every day, perhaps for months, it gnaws the inside of the caterpillar, and though at last it has devoured almost every part of it except the skin and intestines, carefully all this time it avoids injuring the vital organs, as if aware that its own existence depends on that of the insect upon which it preys! . . . What would be the impression which a similar instance amongst the race of quadrupeds would make upon us? If, for example, an animal . . . should be found to feed upon the inside of a dog, devouring only those parts not essential to life, while it cautiously left uninjured the heart, arteries, lungs, and intestines, — should we not regard such an instance as a perfect prodigy, as an example of instinctive forbearance almost miraculous? [The last three quotes come from the 1856, and last pre-Darwinian, edition of Kirby and Spence's Introduction to Entomology.]

This tradition of attempting to read moral meaning from nature did not cease with the triumph of evolutionary theory in 1859 — for evolution could be read as God's chosen method of peopling our planet, and ethical messages might still populate nature. Thus, St. George Mivart, one of Darwin's most effective

evolutionary critics and a devout Catholic, argued that "many amiable and excellent people" had been misled by the apparent suffering of animals for two reasons. First, whatever the pain, "physical suffering and moral evil are simply incommensurable." Since beasts are not moral agents, their feelings cannot bear any ethical message. But secondly, lest our visceral sensitivities still be aroused, Mivart assures us that animals must feel little, if any, pain. Using a favorite racist argument of the time — that "primitive" people suffer far less than advanced and cultured folk — Mivart extrapolated further down the ladder of life into a realm of very limited pain indeed: Physical suffering, he argued,

...depends greatly upon the mental condition of the sufferer. Only during consciousness does it exist, and only in the most highly organized men does it reach its acme. The author has been assured that lower races of men appear less keenly sensitive to physical suffering than do more cultivated and refined human beings. Thus only in man can there really be any intense degree of suffering, because only in him is there that intellectual recollection of past moments and that anticipation of future ones, which constitute in great part the bitterness of suffering. The momentary pang, the present pain, which beasts endure, though real enough, is yet, doubtless, not to be compared as to its intensity with the suffering which is produced in man through his high prerogative of self-consciousness [from *Genesis of Species*, 1871].

It took Darwin himself to derail this ancient tradition — and he proceeded in the gentle way so characteristic of his radical intellectual approach to

nearly everything. The ichneumons also troubled Darwin greatly and he wrote of them to Asa Gray in 1860:

I own that I cannot see as plainly as others do, and as I should wish to do, evidence of design and beneficence on all sides of us. There seems to me too much misery in the world. I cannot persuade myself that a beneficent and omnipotent God would have designedly created the Ichneumonidae with the express intention of their feeding within the living bodies of Caterpillars, or that a cat should play with mice.

Indeed, he had written with more passion to Joseph Hooker in 1856: “What a book a devil’s chaplain might write on the clumsy, wasteful, blundering, low, and horribly cruel works of nature!”

This honest admission – that nature is often (by our standards) cruel and that all previous attempts to find a lurking goodness behind everything represent just so much special pleading – can lead in two directions. One might retain the principle that nature holds moral messages, but reverse the usual perspective and claim that morality consists in understanding the ways of nature and doing the opposite. Thomas Henry Huxley advanced this argument in his famous essay on *Evolution and Ethics* (1893):

The practice of that which is ethically best – what we call goodness or virtue – involves a course of conduct which, in all respects, is opposed to that which leads to success in the cosmic struggle for existence. In place of ruthless self-assertion it demands self-restraint; in place of thrusting aside, or treading down, all competitors, it requires that the individual shall not merely respect, but shall help his

fellows. . . . It repudiates the gladiatorial theory of existence. . . . Laws and moral precepts are directed to the end of curbing the cosmic process.

The other argument, radical in Darwin’s day but more familiar now, holds that nature simply is as we find it. Our failure to discern a universal good does not record any lack of insight or ingenuity, but merely demonstrates that nature contains no moral messages framed in human terms. Morality is a subject for philosophers, theologians, students of the humanities, indeed for all thinking people. The answers will not be read passively from nature; they do not, and cannot, arise from the data of science. The factual state of the world does not teach us how we, with our powers for good and evil, should alter or preserve it in the most ethical manner.

Darwin himself tended toward this view, although he could not, as a man of his time, thoroughly abandon the idea that laws of nature might reflect some higher purpose. He clearly recognized that the specific manifestations of those laws – cats playing with mice, and ichneumon larvae eating caterpillars – could not embody ethical messages, but he somehow hoped that unknown higher laws might exist “with the details, whether good or bad, left to the working out of what we may call chance.”

Since ichneumons are a detail, and since natural selection is a law regulating details, the answer to the ancient dilemma of why such cruelty (in our terms) exists in nature can only be that there isn’t any answer – and that framing the question “in our terms” is thoroughly

inappropriate in a natural world neither made for us nor ruled by us. It just plain happens. It is a strategy that works for ichneumons and that natural selection has programmed into their behavioral repertoire. Caterpillars are not suffering to teach us something; they have simply been outmaneuvered, for now, in the evolutionary game. Perhaps they will evolve a set of adequate defenses sometime in the future, thus sealing the fate of ichneumons. And perhaps, indeed probably, they will not.

Another Huxley, Thomas's grandson Julian, spoke for this position, using as an example – yes, you guessed it – the ubiquitous ichneumons:

Natural selection, in fact, though like the mills of God in grinding slowly and grinding small, has few other attributes that a civilized religion would call divine. . . . Its products are just as likely to be aesthetically, morally, or intellectually repulsive to us as they are to be attractive. We need only think of the ugliness of *Sacculina* or a bladder-worm, the stupidity of a rhinoceros or a stegosaur, the horror of a female mantis devouring its mate or a brood of ichneumon flies slowly eating out a caterpillar.

[It is amusing in this context, or rather ironic since it is too serious to be amusing, that modern creationists accuse evolutionists of preaching a specific ethical doctrine called secular humanism and thereby demand equal time for their unscientific and discredited views.] If nature is nonmoral, then evolution cannot teach any ethical theory at all. The assumption that it can has abetted a panoply of social evils that ideologues falsely

read into nature from their beliefs – eugenics and (misnamed) social Darwinism prominently among them. Not only did Darwin eschew any attempt to discover an antireligious ethic in nature, he also expressly stated his personal bewilderment about such deep issues as the problem of evil. Just a few sentences after invoking the ichneumons, and in words that express both the modesty of this splendid man and the compatibility, through lack of contact, between science and true religion, Darwin wrote to Asa Gray:

I feel most deeply that the whole subject is too profound for the human intellect. A dog might as well speculate on the mind of Newton. Let each man hope and believe what he can.