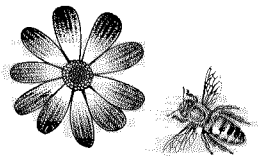

Evolution will not evolve us

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Humans have so far escaped many of the evolutionary restraints to which other organisms are exposed. But we are fast approaching those limits. Do we evolve culturally to live within these limits? [D.E.M.]

Humanity is nature. There is nothing unnatural about humans and their actions, even their destructive ones. We are but one of the millions of evolutionarily fine-tuned works of random biotic art, and I will argue that what distinguishes us from other species is not that we are unnatural in our destructive tendencies, but that as a species we are falling prey to unguided freedom. I will also argue that humans have reached a "point of no return" in the sense that we are beyond the benefit of natural selection.

One could call the largely unpredictable (or at least genetically unprogrammed) behaviour of humans acts of free will, lack of biological determinism, or blank computer disks! Whatever you call it, humans have evolved into a destructive species, thereby ensuring our survival. Maybe that is what was intended. After all, exploitation is part of nature; destruction is, too. Take, for example, the often mutual relationship between pollinating insects and flowers: the insects consummate the flowers' version of sex. As an attractor or reward, nectar is an expensive sugary soup produced by the plant to ensure a happy marriage and the mixing of hopefully beneficial genes in the progeny. Many flowers have even specialized their shape and size to accommodate a narrow array of responsible pollinators. And yet into this productive and harmonious partnership, come the "cheaters."

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In this case, the cheaters are not clever thinkers like humans, but clever arrangements of evolutionary genetic programming that allows them to exploit their version of an "oil well." By specializing in cutting the base of the flower, these thieves or "nectar robbers" have found a way to drain the nectar without providing the pollination. What would be the result of over-exploitation in this situation? A situation that I am sure has occurred numerous times in evolutionary history: the robber enjoys a period of high population and prosperity and the population of flowers remains stagnant for some time. Without an upper limit on the exploitation of the

Bombus occidentalis robbing *Ipomopsis aggregata* (Photo: David W. Inouya)

destroyer, and without a lower limit on the reproduction of the flowers — eventually both populations crash and fall extinct. And yet, as part of the endless evolutionary timeline, there have been some delicate balances struck whereby a flower, its pollinator, and even its floral nectar-robber can each exist without demise. Although there are endless examples, I will not further discuss the destructive and even cannibalistic nature of many of our evolutionary relatives.

Humans are parasites, and parasitism is an integral part of nature. There is nothing dirty, evil, or intrinsically negative about parasites. Remember, though, that the best

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Here, *Bombus occidentalis* is robbing *Delphinium nelsoni* (Photo: David W. Inouya)

parasites keep their hosts alive: a parasite without a host is a predator with no more food. Curiously, humans seem bent on destroying the Earth, our host. Do we simply exploit our host out of need?

Are human beings programmed for destruction? And if so, what does this mean for our survival? Is it bad or wrong? For most of humans' time on Earth under low population levels, we have exploited without consequence. Metaphorically, we had left enough flowers and pollinators to ensure our and their reproductive success. With a burgeoning population, this situation is changing. We are poised to be the instruments, direct and indirect, of extinction for many species. Possibly our own.

Is that a bad thing? Extinction is not really taboo, it is only part of a natural cycle. Let us not forget that our species is part of "the cycle" — only with the blessing or curse of freedom to override evolutionary forces (guns, eyeglasses, bulldozers, etc.). Oil, wood, and cultivated shrimp from ponds are our equivalents of the nectar-robbers. Do I argue for the end of mining, forest clearing, and damming of rivers? Of course not. This would simply be a reactionary view equal to the call for no nectar for the nectar-robber. But perhaps we have gotten too good at beating natural selection — accelerating our cause with little regard to our symbiotic partners.

Are we doomed to extinction so soon? If so, it will not be caused by natural selection, but by self-imposed thoughtful selection, untrammeled freedom. Like other organisms, we manipulate the animate and inanimate world around us. Parasitism, mutualism, and extinction are all of part of the cycle in our hands. The evolutionary process did not hard-wire humans to build things like computers — it only gave us the potential hardware required. The same "technology" will either lead us to conservation or extinction.

The basis for conservation must be a society rooted in a (simple) intellectual and ecological understanding of nature and its dynamics. Other anthropocentric and biocentric arguments promoting conservation exist — often cited are the pharmaceutical and economic value of biodiversity or the mystical beauty of the largely unexplored natural realm. I suggest that it will not be new cancer drugs or transcendental enlightenment that will pave the road to conservation, but rather a better understanding of the organisms and interactions that surround us. Human extinction in the next 1,000 years will not be due to fate. Plainly, we will have overexploited to our own demise. At this point nature can no longer fine-tune us (read, evolve us) to be any better, more responsible nectar-robbers — that is up to the inventors, engineers, and educators.

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A "secondary nectar robber" takes advantage of the hole made by *Bombus occidentalis* to rob *Pensremon strictus* (Photo: David W. Inouya)

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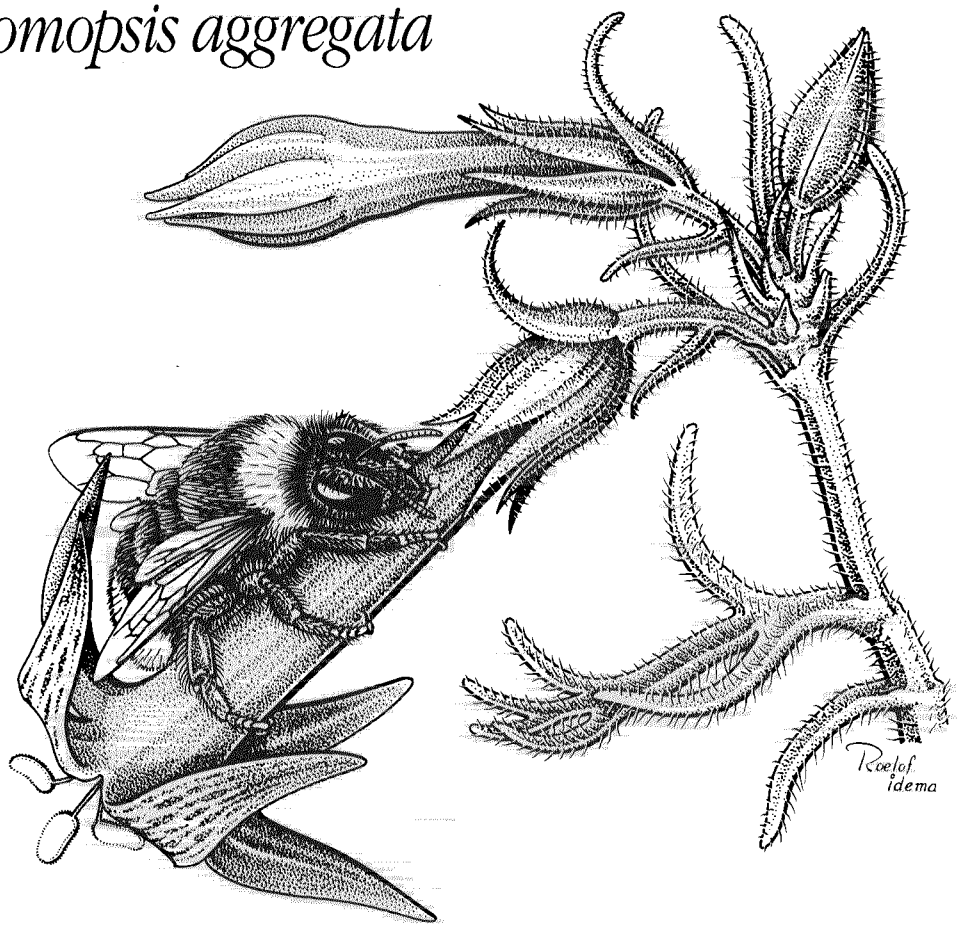
Bombus occidentalis robbing *Ipomopsis aggregata*



Nectar robbing is a strategy exhibited by some species of birds, bees, wasps, and other arthropods in which nectar is obtained through holes bitten near the base of corolla tubes of flowers. This process allows the robber to avoid contact with the sexual parts of the flowers. Flower forms have adapted to allow specific forms of pollinators access to nectar, thus rewarding the service of pollination. Some plant species have flower with sympetalous, or sealed, corollas, thus nectar robbing is the only means by which organisms not specifically adapted to those flowers can obtain nectar.

Primary nectar robbers bite through sympetalous corollas. Most are short-tongued bees, especially carpenter ants (*Xylocopa spp.*), and some bumblebees (*Bombus spp.*). Other primary robbers are insects, such as wasps (*Vespa spp.*), some beetles, and birds such as cinnamon-bellied and slaty flowerpiercers as well as honeycreepers. Secondary robbers use the holes provided by primary robbers, and are most commonly honeybees (*Apis mellifera*) and bumblebees. Some other insects such as honeybees and short-tongued bumblebees feed on polypetalous, or unsealed, corollas, but do not damage the corolla bases. These individuals force their mouth parts between the sepals and petals to get at the nectar source.

Primary nectar robbing exists because it is energetically efficient when there is a poor physical fit with the flower and no other nectar sources may be available. It appears to be a learned behaviour and is most common in nectar-feeding arthropods with short mouth parts. Though nectar robbing has only a slight negative impact on seed set, some plants have developed thicker corolla bases, presumably as a defence. Dense inflorescences, such as in clovers, protect against nectar robbing. In general, nectar robbing may promote a greater diversity of species, permitting, for example, two short-tongued bumblebees, one a robber and the other a specific pollinator, to co-exist.