

Birds, Bees

Paul Wilson and Maria Clara Castellanos*

We are sitting in an alpine meadow on the saddle between Iztaccihuatl and Popocatepetl, the legendary volcanoes that rise up as gods from the Valley of Mexico. The legend is one of incalculable love. Izta was a beautiful princess, Popo a brave warrior. They had a thing for one another. But then Popo had to go off to war, and Izta died of horrid doubt. When he returned, Popo took her body and laid it out, forming the mountain on which we are now studying flowers, and with his torch, which still burns and could rain ash on Mexico City at any moment, he still crouches next to her, ever in love, ever loyal.

We are studying the last key species on a hit list of plants that we have followed for the last three summers. This one is *Penstemon gentianoides*. There are thousands and thousands of them here, but the species is confined to Izta-Popo and a few other high volcanic peaks in central Mexico. The flowers are the color of grape juice, a darker purple than that of the French kings. The floral tube expands into a nearly globe-shaped vestibule. The anthers that bear pollen and the stigma that receives it are pressed against the roof of the vestibule. At the back of the vestibule, the floral tube abruptly contracts, and that is where the nectaries are found.

We are watching the lovers of these flowers: bumblebees and hummingbirds visit *Penstemon gentianoides* to drink the sweet nectar. There are a few species of both bumbles and hummers on Izta-Popo, and we think that the various species within each class are more or less interchangeable in terms of how well they pollinate the flowers. But we also think that the bees differ from the birds from the flowers' point of view.

The bees crawl into the vestibule, where they stand and probe for nectar, pressing their bodies up against the anthers and stigma. A bee body is bristly. It is extremely good at removing pollen from anthers. In fact, the sole source of protein for raising larval bees is pollen, and bees have many elaborate combs, brushes, and behaviors that facilitate the gathering of pollen grains. We can see stripes of white *Penstemon* pollen on the backs of our bees where it has accumulated from recent visits to *Penstemon* flowers.

Hummingbirds are another kind of animal. They drink the nectar of our flowers while hovering, sticking their long beaks and longer tongues into the nectar

wells. Through binoculars from a few meters away, we cannot see any pollen on the birds. Looking at the placement of anthers in the vestibule and the way the birds stick their beaks upward, it seems mechanically unlikely that they remove much pollen, and if they aren't removing pollen, then they certainly are not transferring it to stigmas.

We have come to Izta-Popo to test an idea. The idea is that natural selection shapes bee-flowers to present their pollen gradually and hummingbird-flowers to present their pollen rapidly. This pattern is predicted by pollen presentation theory, a body of thinking developed over the last decade by researchers out of our advisor's lab at the State University of New York at Stony Brook. Pollen presentation theory addresses the optimal speed at which one would imagine natural selection has shaped anthers to present their pollen. Should the anthers open rapidly and at the same time, or should the flowers make their pollen available in many small doses?

The answer to this question, in theory, depends on a number of factors. For instance, if the plant habitually lives in a situation where visitors are very rare (maybe it blooms in the cold cloud forests), then when a pollinator does on occasion show up, the plant should load all of its pollen onto that rare messenger. On the other hand, there are circumstances when the optimal strategy is for flowers to dose a little bit of pollen out onto each of many visitors. How this could be the case was explained by Lawrence Harder and our advisor James Thomson in 1989. Harder and Thomson thought about how bumblebees handle pollen. Bees gather pollen onto their bristly bodies. A few lucky pollen grains may subsequently get brushed onto stigmas where they have a chance at siring seeds. Many other grains fall into the air or are groomed by the bee from its fur into its pollen baskets where it will be taken home as food for bee larvae. The pollen that is so wasted (from the plant's point of view) has no chance of siring seeds. Therefore, a feature of the plant that could reduce pollen wastage would be favored by natural selection. In the case of flowers that are pollinated by bees, Harder and Thomson theorized that gradual and incomplete opening of the anthers is just such a feature: relatively small amounts of pollen get onto the bee's body in any one visit, and the bee waits until the pollen builds up before it grooms, so on a per-pollen-grain basis, more pollen has a better chance of getting to stigmas when a small amount is put on each of many bees than when a large amount is put on the first bee to visit a flower.

The key factor that causes many small doses to be better than a few large doses is the relationship between the number of pollen grains removed in a visit and the number of those grains that are eventually deposited on stigmas. The theory assumes that the relationship is one of diminishing returns: doubling the amount of pollen that is removed less than doubles the amount of

* Paul Wilson, Department of Biology, California State University, Northridge. Maria Clara Castellanos, Department of Zoology, University of Toronto.

that pollen that gets to onto stigmas. The degree of deceleration can be estimated as a value called g , from an equation in which deposition is a function of

removal raised to the power of g : $D=R^g$. Notice that if g were 1, then deposition would increase linearly as a function of removal. It is impossible for g to be greater than 1, and we believe it is often substantially less, i.e., deposition is a decelerating function of removal. It is only common sense to suppose that there would be some diminution of returns.

What about data? James and Barbara Thomson have been able to measure g in nature for glacier lilies being visited by bumblebees. Most individual glacier lilies have yellow pollen, but a few individuals have red pollen. The Thomsons took one red-pollened individual at a time and placed it in a meadow of yellow-pollened plants. A bee would visit it, then go about her business visiting a series of yellow-pollened plants. The Thomsons would follow the bee and pick all of the stigmas of the next 40 flowers that she visited. They would then count the number of red pollen grains on those stigmas. They also calculated the number of pollen grains the bee removed from the red donor. From these data, they estimated g to be 0.33, substantially less than 1.

A few years after this work with bees, we began thinking about pollen transfer by hummingbirds. First, hummingbirds have no interest in pollen. They have no special adaptations for removing or carrying pollen. We therefore guessed that given the same pollen presentation schedule, hummingbirds should remove less pollen per visit than bees. Second, although hummers may groom pollen off of their bodies as a matter of cleanliness, grooming for hummingbirds is not a part of foraging. This made us guess that for hummers g might not be so much less than 1. Are there any data on either of these points? Yes. A team of pollination biologists at The Rocky Mountain Biological Lab (Diane Campbell, Randy Mitchell, Nick Waser, and others) who study scarlet gilia have data on both of these points from experiments with hummingbirds in a flight cage. First, they have found that hummers remove around 20% of the pollen that is presented in their first visit to a flower; this is in contrast to numbers for bees that are around 80% of the pollen presented. Second, although the flight-cage conditions were artificial and the recipient flowers had to be emasculated in order to allow pollen to be tracked, it is possible to estimate g from their data. For hummingbirds visiting scarlet gilia, g was 0.68, in other words, greater than the value of 0.33 that the Thomsons got for bees visiting glacier lilies. From all this theory, emerged our prediction: flowers adapted to hummingbird pollination should have more rapid and more thorough pollen presentation than close relatives pollinated by bees.



We set out to test this prediction by comparing bird- and bee-flowers in *Penstemon*, but before we can explain our findings about pollen presentation, we have to turn to the more general issue of whether or not it even makes sense to talk about bird-flowers versus bee-flowers. Textbooks present a tidy categorization of flowers into pollination syndromes. A pollination syndrome (to the extent that it exists) is an association of floral characters with each other and with pollination by a certain class of animals. Hummingbird flowers are said to be red, to have long and narrow floral tubes, to have exerted anthers and stigmas that protrude beyond the narrow tube, to lack a landing platform, to have an inclined or nodding orientation, to produce copious amounts of nectar, to have dilute nectar, and to have nectar that is rich in sucrose relative to glucose and fructose. Conversely, bee flowers are classically said to be blue, purple or yellow but not red, to have shorter or broader floral tubes, to have anthers and stigmas that don't stick out as far, to have a pronounced landing platform, a sturdy horizontal orientation, and to produce smaller volumes of more concentrated nectar, that is rich in hexoses. But are flowers so easily categorized?

Another way to ask the question is, "Are flowers specialized on classes of pollinators?" When asked this way, the answer is, "Sometimes." Sometimes the specialization is amazingly specific, for example, flowers that look and smell like rotting flesh and are pollinated by carrion flies, or orchids that feel and smell like female bees and are pollinated by lusty but confused male bees, or figs that can only be pollinated by fig wasps who are willing to tear off their wings and antennae to get inside the fig. There are many more species of flowers, however, that are effectively pollinated by a wide array of animals. If you wander around the countryside looking at flowers, you will find that most species are visited by bees, flies, beetles, wasps, moths, and occasionally birds or bats. Perhaps the majority of plant species are generalists at the level of being attractive to all sorts of flower-visiting insects.

After all, there is an obvious circumstance under which natural selection over the long run can favor being a generalist, namely, when any particular class of pollinators is unreliable relative to the broader spectrum of pollinators. Imagine that from year to year or decade to decade there are fluctuations in the abundance of bees and more or less independent fluctuations in the abundance of flies and more or less independent fluctuations in the abundance of beetles. A trait (say floral tube length) that excludes some visitors over others (short-tongued visitors over long-tongued species) might well be selected for during some years but selected against during other years. During years when bee abundances are low, the population will be pushed toward allowing beetles to have access and thereby using them to transport pollen, even if bees are better pollinators than beetles. Generalization should

be favored when the fluctuations in the abundance of pollinators occur at a faster rate than the evolution of specialization. Plants that have bloomed through the eons under circumstances where a particular class of pollinators has been reliably present may evolve to be specialized. Everyone else is selected to be a generalist.

On Izta-Popo, we are watching flowers of *Penstemon gentianoides* that are being visited by both birds and bees right before our eyes. Does it make sense for us to be testing pollen presentation theory by comparing bee-syndrome penstemons to bird-syndrome penstemons? Is there a syndrome distinction that exists in *Penstemon*? To our surprise and delight, the answer seems to be in the affirmative. We have studied the pollination of about 60 species to date. We record the animals that we see visiting the flowers in as many populations as we can find, and we make notes on whether they appear to be getting pollen on their bodies and effectively moving pollen from flower to flower. Admittedly, there are species, like *Penstemon gentianoides*, that are visited by both bees and birds, but by and large it is very easy to determine for each of our censuses which kind of animal is the principal pollinator. Today on Izta-Popo, both are visiting, but bumblebees are moving huge quantities of pollen, and hummingbirds are moving almost none. Often, the determination is even more clear-cut. Often, there are no bees collecting nectar at the red-flowered species, although we often find tiny bees that collect pollen. Often, we see no hummingbirds at the purple-flowered species.

We can go farther than showing an association between principal pollinators and flower color. We have also considered seven other characteristics by which bird-pollinated flowers differ from bee-pollinated flowers: floral tube constriction, exertion of anthers and stigma, landing platform prominence, flower orientation, nectar production, nectar concentration, and the rapidity of pollen presentation. Are the characters associated with each other and with principal pollinator type? Yes. Within *Penstemon*, hummingbird pollination has arisen many times in separate evolutionary lineages. With *Penstemon gentianoides*, we are completing a survey of seven such branches. For each lineage, we have one species that is hummingbird-pollinated and one that is bee-pollinated. *Penstemon gentianoides* is principally bee-pollinated, but its close relative, the beautiful strawberry-colored *Penstemon hartwegii*, is hummingbird-pollinated. We have studied six other such pairs of close relatives. For each pair and for each of the eight characteristics, we can ask, does the difference conform to what has been classically expected of bird- versus bee-pollination syndromes? In some cases the closely related species don't differ enough to give a clear answer. In 49 cases they do. Of the 49 hypotheses we were able to test, 48 of them conformed to expectation, and 1 contradicted expectation. This is overwhelming evidence for the

reality of the bird- versus bee-syndrome distinction in *Penstemon*.

How did our prediction fare about pollen presentation? There was one tie. The species pair *Penstemon newberryi* (bird-pollinated) and *Penstemon davidsonii* (bee-pollinated) both have anthers that open widely and quickly. Interestingly, these species have densely woolly anthers. They look like they are fringed with the fleece of a sheep. We don't know what (if any) function the wool has for pollen presentation, and we do not count this pair as being for or against our prediction. In each of the other six species pairs, the bird-pollinated species has anthers that open more widely and more rapidly than the bee-pollinated species. How this is manifest varies from species pair to species pair. In one pair, the bird-pollinated species *Penstemon rostriflorus* has anthers that open up widely like the double barrels of a sawed-off shotgun, whereas the bee-pollinated species *Penstemon leatus*, has anthers that just barely crack open along a narrow slit. There are teeth along the slit, and these rasp against the backs of the bees, thereby vibrating pollen out onto the animal's body. It seems mechanically improbable that any pollen would get on a hummingbird (although we can't verify this because we've never seen a hummingbird visit a *Penstemon leatus*). Other species pairs have other mechanisms by which the speed of pollen presentation is regulated.



Having posed a theory about how natural selection works on anthers, having shown the existence of pollination syndromes in penstemons, and having confirmed a prediction of the theory, we are now left standing on Izta-Popo with a warm glow in our hearts, but the cold fog is rolling up the mountain and all of our success has left us with an additional question: Why is it that pollination syndromes work so well in *Penstemon*? We are looking at both bees and birds visiting the flowers of *Penstemon gentianoides*. Why are these flowers not intermediate between the two idealized syndromes? The proximate explanation for why hummingbirds are visiting these flowers is probably that they are full of nectar, there are thousands and thousands of them in this place, and the bees cannot possibly empty the fields of nectar that are presented on the slopes of Izta-Popo. The hummingbirds are understandably foraging on a superabundant resource. But what of the evolutionary explanation for why the flowers have all the features of the bee-pollination syndrome? Pollen presentation theory suggests an answer.

A decade ago, the Thomson lab started work on how pollination proceeds when there are two or more kinds of visitors. We did a study on jewelweeds that were being visited by both nectar-collecting bumblebees and pollen-collecting honeybees. The bumblebees would enter the flowers right-side-up and probe for

nectar. In the process they would get pollen on their backs without actively manipulating the anthers in any way, and they would brush pollen from their backs onto stigmas also without going out of their way to do anything more than probe for nectar. The honeybees, on the other hand, would turn upside-down in the jewelweed flowers and scrape the anthers with their mouth parts. Not surprisingly, we found that the pollen-collectors removed twice as much pollen as the nectar collectors in a single visit. More interestingly, the pollen-collectors deposited less than a tenth as much pollen as the nectar collectors. The pollen collectors were high-removal-low-deposition visitors compared to the low-removal-high-deposition nectar collectors.

We then studied two patches of jewelweeds. In the first patch, there were mostly nectar-collecting bumblebees. Pollen was removed in moderate amounts from the flowers over several hours and pollen was deposited on stigmas increasingly throughout the day, so that after seven hours stigmas were loaded with 700 pollen grains. In the second patch, there were some nectar collectors but many more pollen collectors. In this patch, pollen was thoroughly removed from flowers within an hour after they were unbagged, and there was almost no pollen deposited on stigmas. Just a few grains were deposited after seven hours. What seemed to be happening was that in the second patch, pollen collectors were removing all the pollen from the system so rapidly that it never got on the backs of nectar-collecting bumblebees. So, even though there were some good pollinators present, they didn't move any pollen. The pollen-collecting honeybees were parasites on the system, depleting pollen in a way that made the nectar collecting bumblebees ineffective.

Barbara and James Thomson wrote a computer model to simulate these dynamics. The program allows one to specify the rates of pollen removal and deposition of several types of flower visitors. The virtual visitors then visit virtual flowers, and you can watch virtual pollen disappear from virtual anthers and build up on virtual stigmas, or not build up, as the case may be. If you run the program with high-removal-high-deposition visitors, a lot of pollen is transported quickly. If you run the program with low-removal-high deposition visitors, pollen also builds up, although it takes more visits. If in addition to having good visitors present, you also include high-removal-low-deposition visitors (like the pollen-collecting honeybees), then less pollen gets deposited on stigmas than with just the good visitors, even though the total number of visitors has increased. The evil visitors lower the overall amount of pollination. They are parasites, although only in the presence of good visitors (because if good visitors were not present, then they would indeed effect a small amount of pollination).

What this means for *Penstemon* is that bees may be pollen-parasites when visiting hummingbird-syndrome species in the presence of hummingbirds. Remember that we believe that bees are high-removal-low-deposition visitors, whereas hummingbirds are low-removal-high-deposition visitors. Plants that have adapted to hummingbird pollination, will have anthers that present their pollen nearly all at one time and on open platters. When pollen is presented like this, if a bee flies up and visits the flower, it removes 80% of the pollen and deposits only a small proportion of the large amount that it removed. The bee would be removing pollen from the system that might otherwise have been transported to stigmas by hummingbirds. Any feature of the flower that could discourage visitation by bees would then spread in the population. Flowers might be selected to have narrow floral tubes that keep bees out, dilute nectar that bees don't find particularly appealing, and so on. This would drive the plants to match the hummingbird syndrome better and better.

In the other direction, let us imagine other lineages are being principally pollinated by bees. These plants will have anthers that present just a little bit of pollen at a time and dispense it through anthers that are only partially opened, as through the narrow slit of *Penstemon leatus*. When pollen is presented like this, if a hummingbird flies up and visits the flower, it removes almost no pollen and so it deposits almost no pollen. In the currency of pollination, the hummingbird visit might just as well not have happened. The hummingbird removed nectar without effecting pollination. Empty nectaries, in turn, might make the plant less attractive to bees. Any feature that could further attract the bees would be selected for, and features that make the flowers attractive to hummingbirds might even be selected against. The flowers would remain purple, vestibular, with landing platforms, and concentrated nectar.

Metaphorically, there are two adaptive peaks. The flowers cannot have anthers that make both hummingbird- and bee-pollination optimal at the same time, one or the other but not both. Flowers could be half-way in-between and not pollinated well by either class of animal. We can imagine such an intermediate being maintained if birds and bees were each unreliable in any given year but collectively more reliable taken together. However, *Penstemon* flowers as a whole tend to bloom late in the flowering season at a time when hummingbirds are almost guaranteed. Any one species of bee is not guaranteed, but the suite of bees and wasps that visit bee-syndrome penstemons is also nearly a sure thing. So, our suggestion is that under these conditions optimizing pollen presentation could conceivably be a key step in the specialization of penstemons into floral syndromes.

To take the metaphor even farther, maybe just for romantic emphasis, it might be as though *Penstemon*

gentianoides has fallen in love with bee pollination (or become addicted to it). Its gradual pollen presentation has made *Penstemon gentianoides* evolutionarily loyal to bees. We do not suppose it is a love so strong as to match that of Popocatepetl for Iztaccihuatl, not a love past death. If bees were to die out upon the earth, then hummingbirds would probably effect some small amount of pollination, and over time, we would expect *Penstemon gentianoides* to open its anthers more widely to a new lover.*

/December 2001

Ilse's Cat

Paul Wilson*

Dogs and parrots make the obvious mistake of thinking that humans are dogs or parrots. With cats it is not so obvious. I do not think the cat I live with thinks I am much of cat, but I am inclined to mistake it for a human, which is to its benefit. This cat is called Ilse's Cat, which is a descriptive name. It was a stray that my housemate, Ilse, let into the house in November. In January Ilse went to Brazil for a year, and there is no indication that when she returns she will come back to this house or take the cat away. We got the cat its shots and got it spade. It is not my cat. It is just a cat I live with.

Ilse's Cat manages to behave like a cat and to still make me think she is a human. She sleeps a good deal, eats rodents, and licks herself. It is clear she is a cat. But then she comes over to be with me. When I go to bed, she will often come lie next to me for a few minutes, snuggle a bit, asked to be stroked. And then she moves away to her spot on the chair next to the bed. She doesn't usually sleep there except at night. I think that she wants to be near someone. It is not just a matter of wanting to be groomed or wanting the warmth. It is the company that she desires.

Ilse's cat is cognizant of what we call personal space. There are times when she doesn't want to be messed with. There are other times when she seeks to have her space invaded. And there are times when she is open to being convinced if she is approached subtly. She is a polite person, but there has never been any doubt that she is her own person. This is cat pride, but it is also remarkably reminiscent of what we would call a sense of self, individuality, independence.

The cat is not a dog. She wants me to like her, but she does not live for it. Dogs expect to be treated like dogs treat dogs, and when you ignore them, they look at you with the confusion of the rejected. Ilse's Cat does not want me to treat her like a cat would treat a cat. She has never looked in the slightest bit confused. She does want attention. If no one else is in the house for a day or two, when we return she has obviously missed us. She enjoys company, but she also knows how to accept solitude. Among humans, she would be a Zen master or a Spartan stoic.

Ilse's Cat sometimes gets me up in the morning. I have never quite figured out why. I never feed her or do anything in the morning that an animal should learn to anticipate with eagerness. But she waits until I am just starting to stir, and then comes over and starts

walking on my chest. We think of cats as nocturnal, but this one at least is really matinal. It makes me realize that even though I am a morning person relative to the humans around me, I am corpuscular in a global sense. As soon as I am out of bed, Ilse's Cat charges down the stairs.

Some people are made uncomfortable by dead air. Not Ilse's Cat. We go for hours without communication. From time to time we look at each other. Then we look away. I go on reading. She turns back to the window, and looks out at the squirrels running up and down the sugar maples outside the house. She watches the gray bushy tails careening around chasing each other, and the red squirrel who has the beautiful ears, and the innumerable chipmunks who live in the stone walls around the house.

We used to let Ilse's Cat come and go in and out of the house at her leisure. I made a cat door in the bottom of the kitchen window, and we all acted like responsible adults. The cat went out from time to time and nabbed a rodent which she then brought into the house and killed—slowly. Some got away briefly but all were eventually terminated. After termination, they were frequently ingested, except for the skull and upper viscera. The remains were left on the floor for disposal by humans.

When spring came upon us, the catch increased. There were days when I witnessed the destiny of four chipmunks and two meadow voles. Since the voles are dispatched quickly, their demise is less likely to be witnessed. Voles are the feline equivalent of granola bars. Chipmunks are a full meal. And the chipmunks are more evasive. Because they tend to temporarily escape, there came to be a non-zero equilibrium abundance of half-eaten chipmunks in the house. We had to close the cat door. I was very sorry to have to do this because I thought I was taking away the freedom of another person.



Young biologists are often admonished for their native anthropomorphism. It is a kind of sin against science, the moral equivalent of frequenting a house of ill fame. Biologists of my advisor's generation were raised to be more proper than we were, but even so I would hardly relish the idea of my colleagues calling me anthropomorphic, even though I am, and even though I do not think it is all bad.

It is definitely not all good. Biology in many ways is the opposite of anthropomorphism. If you think a cat thinks like a human, you are anthropomorphic. If you as a human are able to think like a cat, you are a biologist. Biology is turned outward. We are always trying to think like cells acts, like seedlings grows, like honey bees forage. Biology moves our attentions away from ourselves. Each organism has its own point of view. Biologists call the organism's point of view its *umwelt*.

* Paul Wilson, Department of Biology, California State University, Northridge.

The umwelt is the world as the organism sees it with its own organs and its own sense of time and pertinence. The umwelt of other creatures can be very different from our own. The classic example is the umwelt of a tick. The tick has skin that is sensitive not to touch but to light. She climbs up on foliage toward the light. There she sits in wait, sometimes for years, evidently sensing nothing except whether or not butyric acid is in the air. Butyric acid is in the sweat of mammals, and when she senses this she drops down, and if she is lucky, she lands on the mammal, and then she borrows into its fur and drinks of its blood.

The umwelt, in essence, need not be restricted to conscious creatures. Plants do not need to be conscious in order for us to appreciate the world as it exists to them. Strictly speaking, they need not have a point of view in order to be effected by the world around them or to respond to it. Each organized unit, which includes cells and populations as well as individuals, has its own world, and we understand how the organized unit lives its life by understanding what its world is to it.

Coming to know another entity's umwelt is easier said than done. How am I to get inside the head of Ilse's Cat? She does not speak about what she sees. With great effort it would be possible to wire her brain to see how it responds to stimuli, but it would ruin her natural attitude to do anything that invasive. Really, the only effect way I know is to just watch her, study her behaviors, guess at her motivations and ask if the way she behaves is consistent with my guesses, then revise the guesses. My first guess is that she is behaving as if she were a human, and it is a far from perfect guess.

As humans (visually-oriented large warm-blooded restless persons) we are full of our own biases. We do not see the world through clear glasses or the tricorders of Star Trek. Instead, we see a subjective world, a shadow of the whole world. Our shadow is no more real than the tick's shadow. This is a second reason why, in order to sympathize with the situation of another type of organism, it doesn't hurt to start by treating it as a human. Not only is it the easiest starting point, it is the one point of comparison we know of with any certainty.

Literalism, not anthropomorphism per se, is what has the potential to make a fool of us. Konrad Lorenz, one of the founders of the science of ethology, wrote a book on the pets he had known, *Man Meets Dog*, and it is a book with ideas worth thinking about, worth testing, worth improving upon. Darwin also tried to get into the hearts of the animals he lived with. He studied their facial expressions and bodily gestures. His observations became the subject of his theory on the fixation of behaviors that he expounded in *The Expression of Emotions in Man and Animals*. There are wonderfully animated drawings of the dogs and cats

captured on paper forever in the act of feeling what they were feeling.

So, if I try to sympathize with Ilse's Cat, this is what I come up with. Compared to me she is very observant, impressively responsive, and not particularly thoughtful. I can tell she is attentive by how she watches dogs when they come near the house and how she watches rodents out the window and how she watches me. She does this with her eyes and with her ears, and she does it for hours on end, and there is no sign that she is pondering the meaning of it all. She is simply observing. You could call it waiting, but I do not think she is waiting for anything in particular.

I do not think that time is much of a concept in the emotions of Ilse's Cat. She is affected by time. She becomes hungry or in need of a stretch or of the opinion that some scratching of her temples would feel good, but she does not sit there anticipating these things for long. Her attentiveness is also revealed in her reactions. There was a time when a large glass dish was precariously perched in the drainage rack, it fell to floor and smashed into a hundred pieces right where Ilse's Cat had been sitting, but the cat was on the alert, and moved out of the way faster than the dish fell.

Ilse's Cat is a sensual animal. Maybe the sensuality is ultimately derived from sexuality or a mother-kitten bond, but I think the connection is more manifest in my mind than in hers. Humans make the connection overt. Ilse's Cat has never shown any signs of making the connection at all. It feels good (when she is in the mood) to have a man's fingers running through the hair around her neck, stroking her ears back, scratching her temples or the spot under her chin. She likes it because it feels good to be loved. To her the love is not sexual or parental. It is immediate and gratifying.



Except for African lions, the members of the cat family are barely social. They alternate between living alone and with their kittens. They are not like hominids and wolves. We must suppose, then, that the ancestors of domestic cats were essentially solitary. It was not in their nature to hunt with others or to assume a dominance hierarchy. It still is not. This is not to deny that domestication has changed the way cats relate to humans. Kittens who did not enjoy the company of humans were drowned or abandoned. Kittens who did enjoy humans survived nicely, and the genes for enjoyment spread in the population.

While we are guessing at history, was there any confusion involved in the phenomenon of cats living with people? Possibly not. The people may have benefited by being rid of rodents who for those early agriculturalists were surely a nuisance, and the cats may have benefited by shelter from predators and cat food that the people stored up against times of rodent scarcity. I am inclined, however, to suppose that this

was not the whole story. It seems more plausible to think that humans—who have a complex social psyche prone to metaphors—have always mistakenly identified with cats. Cats, then and now, fulfilled and fulfill a desperate need that the humans felt and feel.

This, then, is my guess. Hominids have been family animals from time out of mind, and intimate relations are one of the cornerstones (may *the* cornerstone) of the human condition. Out of this grew what we feel as a need for contact with others, including sensual contact. All this was already fixed in our psyches as we lived in troops, hunting and gathering for thousands of generations. This complex psyche, however, has an insatiable appetite. Now enter on the scene animals such as stray wolves and wild cats. Dogs appealed to one aspect of our psyche, cats to another.

In the case of dogs, the mistake was penetratingly mutual, and artificial selection since then has only made it worse. But with cats, we did not select for them to be our surrogate children and subservient underlings, we selected them if anything to do their hunting on their own and to behave as our peers and our lovers. With the exception of those grotesque special breeds that have recently been molded, we have liked our cats to have a sense of self possession, which they were in all likelihood presuited to appear to have. Cats, like people, are sensual when charmed, and that is how we prefer them.

Neither cats nor humans have had to understand any of this in order for them to go on working their magic with each other. Dogs don't need to either, and they certainly do not. Humans may or may not have figured out what they were doing in the early breeding of pets, but they needn't have had to in order for it to work, to be favored and to be promulgated. Ilse's cat and I do not understand each other. Maybe she thinks I am a cat, if so, probably a kitten that needs to be fed. Part of me does think she is a person. This is all wrongheaded, and I am reminded of a passage of D. H. Lawrence's: "Where is the point to life? Where is the point to love? Where, if it comes to the point, is the point to a bunch of violets? There is no point. Life and love are life and love, a bunch of violets is a bunch of violets, and to drag in the idea of a point is to ruin everything."*

No Words

Paul Wilson*

As you go through life, you encounter teachers, people who you pick up things from. They may or may not know that they are teachers, or be trying to teach you anything, or even know what they are teaching. They may be very kind to you, or they may be like my little brother was to me and teach their lessons in a way that challenges you. Maybe the ones that know what they are doing and do it gently are a little more likely to succeed, but I wonder who among us can look back on our lives and not point to at least one person who we learned something substantial from because the presentation was painful. I also don't really know what is good and what is bad. Maybe I would be happier if I were not a biologist. Maybe I would be happier if I were not an academic. It is hard to know. So, your teachers set you on a road, gently or otherwise, and that is that.

But even not knowing these things, we still honor those who guided us because they made us what we are. The teachers that I honor the most have offered what they had with a light touch, in fact, such a light touch that I'm not sure either of us acknowledged their mentorship at the time that it was occurring. The person I am thinking of is Michael Mesler, who I now usually refer to as "my undergraduate advisor". That is a short hand, though, like saying that Charles Darwin was the ship's naturalist aboard the Beagle. It's simpler than explaining that he was taken along as Captain Fitzroy's educated traveling companion.

Michael didn't start out my advisor. On paper, I had three other advisors before him, at least one of which went well beyond the call of duty. That one took me into the field during the summer after my freshman year, let me live in his house for the rest of my college career, and collaborated with me on a project that ended up being my first scientific publication. By every right he deserves to be spoken of as my undergraduate advisor, but if the distinction goes to one person, it unfairly would not go to him.

Michael's fingerprints can be found upon my spirit, and I'm not even sure why. We are still doing research together. We just got a paper accepted last month. We still visit. We take the time to fly from one end of the state to the other to spend a week each year together. No reasons are given, and neither are any excuses. It's just what we do. And, like it always was, he doesn't say he is my mentor, and I don't say I'm his protégé. On the other hand, I know that we are not *just* friends

and we have never been *just* friends. He has always taught me things, and he has always influenced the trajectory of my career, usually subtly, perhaps without conscious control.

How did I meet Michael? I was a freshman, my first semester. I was just in from the mountains, hadn't really learned to shave yet, certainly had dubious social skills, and was eating up college like chocolate cake—maybe like chocolate cake when you might get caught at any moment. My first day on campus, I had found the herbarium, and was trying to identify a plant I had collected over the summer. The graduate students had never seen anything like me before, and perhaps out of amusement, they took care of me. They showed me where to get cheap burritos and told me botanical jokes. We were nerds. Anyway, they were taking a graduate seminar on coevolution from this guy they called Mike, and one of them said maybe I should show up at class. It might have been a joke, I'm not sure. It seems outrageously impudent, a first semester freshman crashing a graduate seminar, but remember, I had *no* idea whatsoever how to behave.

So, I went to coevolution seminar from time to time, usually without having done the reading, and I didn't even know enough to keep my mouth shut, but Humboldt State a place where people live and let live, and no body told me (really, I mean it, not a single person) that I was doing anything unwelcome. I would leave little notes in Michael's box, "How do species become different?" and he would dutifully photocopy extra readings for me. Years later, when I was visiting, Michael pulled out that particular note and showed me, which is why I remember it. It was so casual and so immature. Even the handwriting looked grade-schoolish.

After Fall quarter, I signed up for Michael's General Botany course. This course became the first concrete block upon which my own intellectual house is built. It's just standard stuff, mostly the tangible nuts and bolts of plant cells and organs, how they are put together and how they work. There was a little bit of evolutionary biology, and a lot of life cycles. A decade later when I was writing my dissertation, as if out of a dream, the first diagram of my first chapter became a twist on the life cycle of flowering plants. Now one of my graduate students and I are working on her thesis, and like a ghost that never leaves you, her first figure has again turned into a life cycle. Michael's voice echoes in my mind. His voice echoes in my heart. When he lectures, his voice is so beautiful. It modulates, loud and soft, fast and slow. I think I fell in love with his voice.

Time passed. The following fall I ended up living in my other advisor's house which was next door to Michael's and a half an hour's drive to school. None of this was planned, but we ended up car pooling nearly every day. We would talk about nothing and everything. I can't remember any of it that was overt

* A contribution to the *Author-and-Merlin Project*. Paul Wilson, Department of Biology, California State University, Northridge.

advise. We spent a fair amount of time listening to music, looking at the rainy season making itself manifest as it is want to do in Arcata. During Winter quarter, I signed up for general education Introduction to Music, and Michael decided to take it with me. It was a friendship across generations, and it was important to us, I'm sure, because I had so much to learn from Michael and neither of us needed to speak of it.

There was during the winter on one or two drives to school some very brief description of Michael's time at the University of Michigan Biological Station at Pellston when he was a graduate student. If you were to read a transcript of the conversation, you wouldn't know that a suggestion had been made. It was hardly a hard-sell. But, one day in spring, Michael showed up at my desk (the grad students had given me a space at the end of an isle of herbarium cabinets), and Michael handed me an application for summer school at Pellston. All he said was, "No words." That was his way of giving me advise. He had written to Pellston to get the application for me, and he didn't lobby, but that was his advise.

I went to Pellston, and I had a great time. The grad students and professors there treated me wonderfully. I leaned about 500 plants that summer, which is probably about as many as I knew from California, so ever since then I've been wondering about the differences. I took a dozen roles of film, and returned with a supremely boring lecture that I didn't have the sense to abbreviate. The graduate students and Michael sat through my slide show politely, I think for an hour and a half. Looking back, it is amazing how much space they gave me to be an adolescent. In addition to the lecture, they let me take control of a newsletter and write long essays on plants, evolution, and the Cosmos. Michael and the grad students would correct my grammar, and occasionally they would cross out a paragraph as just way totally too far out there, but by and large I got to "publish" with stupendous leniency. For one especially self-indulgent essay about my own research, I bypassed Michael entirely, and all he said when it came out was, "I understand why you didn't have me read this first." He said it with a lot of warmth.

In my third year, my other advisor went off on sabbatical, and I was left in an empty house. I found a housemate from among the grad students. We'd eat with Michael and his family two or three times a week, car pool, take classes with him. During the next two summers, I was even closer to him. We were together for hours, pretty much every day. We measured our plants, listened to music, talked about evolution. He took me to my first conference, where I just about shit my pants with nervousness giving a research talk. It was a lousy talk delivered much too staccato. I remember the way in which it was bad. I don't remember Michael criticizing it. What I wonder now is

how he knew that he didn't need to. Over those years I got a huge amount of feedback from him when I asked for it, but when I truly had shown my inexperience, we kind of just moved on.

Much of what passed between Michael and me has been ineffable—not all of it, we had lots and lots of substantive discussions, we have always talk about biology and teaching—but there were other things we chose not to speak out loud, maybe because they were too sensitive, I don't know, but not because they were unimportant or because we didn't care about them. We didn't talk out loud about why he mentored me, why I gravitated to him, how we were the same and different and why that was important to making our relationship work. We didn't talk out loud about how he was the master and I was the pupil.

The story doesn't have an end yet. Nearly every day my life has some connection back to Michael. I hear his voice speaking through me, one among many but in my role as a professor, it might be the strongest voice. I think his thoughts, his among others' but again his has a pre-eminence. And we still work together. The relationship, though, does change as we age. I am more independent. We are more equals. If we wanted to, we could talk about it now. I have a photograph of him reading *The American Journal of Botany*, sitting next to the statue of Walt Disney and Mickey in the center of Disneyland.

Ever the Darwinian, I have one other notion. It is that I am a vessel for the expressions of my teachers who were themselves vessels for the expressions of their teachers. These expressions—ideas about biology, attitudes about mentoring, mannerisms of teaching—are the ones than have held together and made sense, that have had resonance in our souls, and they make us what we are. In other words, I am a life cycle diagram's way of making more life cycle diagrams, and so is Michael, and before him so was his advisor Herb Wagner. As with life cycles, so with the rest of our house.*

/December 1999

A Walk Up the Mountain

Paul Wilson*

It's the weekend and you're ten years old. You wake up at dawn, and get your father up. Your back yard is the Lost Coast. In the Lost Coast, a person can walk all day and the chances of seeing another person are slim to none. Your father carries a nap sack with some apples, some bread, and some cheese. He doesn't say anything. You scoot along ahead of him. You never carry anything. It would weigh you down. You have plenty of energy to run ahead or back or ahead again, but this is because you are an elf. You never wear heavy hiking boots, just tennis shoes. You never carry water, you just drink from springs that bubble up from the ground.

The two of you follow a creek that has cut a gorge where redwood trees grow, and elderberries and big-leaf maples form the understory, and they are covered in feather moss. Your father and therefore you call the most common feather moss, "*Isoethecium*". He is a botanist. You don't really think about this as being different from him being your father. If you thought about it, you would realize that not everyone's father calls plants by their name, but you don't think about it. Your father and therefore you think that the mosses have a tremendous surface area that snarfs up all the mineral nutrients that flow down the trunks of the trees. Your brain uses words like "snarf" and "mineral nutrients" in the same breath.

As the morning wears on, you move up the creek bed, up to higher ground. The redwoods give way to Sitka spruces, and then to Doug firs, and then to tanbark oaks and madrones. The Steller's jays scream at you as you past through their territories. You see some banana slugs in gruesome embrace. You and your father watch them for a few minutes, but then you move on. You've seen banana slugs mating and then chewing off each others penises before. It's no big deal—they don't do it very fast.

Finally at 11:00 o'clock, you come out of the forest and the fog has cleared, and you are standing on the overgrown trail winding up the south side of the mountain through manzanita and silk tassel. The sun is warm. The first gooseberries are blooming, burgundy sepals and snow white petals. As you walk up the hill, a song thumps through your head to the beat of your feet against the trail. Around and around the song goes, and up and up you climb. Your father is far behind now. Although you haven't said so out loud, it is understood you will wait for him at an

appropriate lunch spot, perhaps the rocky outcrop where he studied those lilies last May. It's not much farther.

When you get there, you lie down in the sun, and close your eyes. The rock you are on is cold, and the sun is warm. After a while you roll over and toast the other side. Your father shows up. He is excited about seeing some *Pottia* growing on the bare soil next to the trail. He has collected some and shows you. It is indeed *Pottia*, but so what? The first *Pottia* of the season: you think, «God, it was bound to happen eventually, what's the big deal?» But you don't ruin it for him.

You eat your cheese and bread. You grab an apple, and you say you're going on, up to the top. The top is at 3,200 feet. He says, he's just about had it, you should go on without him. He says not to forget about time, and to turn around by 1:30. He offers to loan you his watch. You look at him like he's out of his mind, but you know that he's a little proud that he can trust you. He can trust you either way—either to take care of the watch, or to come home at the right time without it.

You drink the water that's left in his water bottle, and race up the hill. You know that if you stop, that's the end. You just keep on going like the energizer bunny. Long steps, as fast as you can make them. Up and up. The chaparral starts to thin a bit. There are grassy areas and some live oaks. You've made the flank of the mountain. You are climbing up it. The sun is warm, and there's a little breeze that dries your sweat before it even beads. Your just flying along like the breeze itself, up and up. You feel like you are riding the sprite of the mountain.

Finally just when you ought to be turning back you reach the crest. It's a rocky knoll. The rocks are covered in lichen and *Grimmia* moss. There's some coffeeberry bushes, and some gooseberries. You can see inland from here all the way to the next watershed. Or you can look back the way you came toward the ocean. You turn to go home, and then you see on the ground a primary from a red-tailed hawk. It's a symbol and a trophy. You pick it up and stick it in your pocket. Then you run down the hill.

At the lunch stop you can look toward the ocean and see the fog rolling in. It has engulfed the gulch with the redwoods. It is like a white blanket of cotton. You've made good time. You reckon it is just after 3:00. You take off again down the hill, through the chaparral, through the tanbark oak and the Douglas fir, into the Sitka spruce, and there you find your father sitting on the side of the trail reading Steinbeck. The two of you walk home. You just walk, you don't run.

When you get there, you're tired all over. You plop down on the couch. Your father draws a hot bath. You get in the bath. You breath in the steam. You wash your hair. Your father has built a fire in the stove. He has lit the gas lamp. He is cooking mushrooms in butter, he is boiling rice, and stewing

* A contribution to the *Author-and-Merlin Project*. Paul Wilson, Department of Biology, California State University, Northridge.

apples. After dinner, he reads to you about Bilbo and the dwarves. It's the weekend and you're ten years old.*

November 1999

Henry Brown

Paul Wilson*

Henry was a sweet, sweet old man. He took care of my parents' roses, the neighbors' too. Those roses were so beautiful. My father used to pick one when he came home from work, and then he'd sneak up behind my mother when she was working in the kitchen—he'd stand behind her and slip an arm around her waist and present to her the rose.

After school and on Saturdays, I used to follow Henry around. He would tell me stories about old friends he had had when he was young and about exploring Hell's Half Acre, about snakes and gators and a dog named cat. Henry knew how to keep a young boy's attention. The stories were rich in detail. You could smell the jasmine. You almost stepped on that water moccasin. You could think like a sea trout in Dickerson Bay. I never knew if they were true, I never knew how true they were.

Looking back, I realize that he took care of more than my parents' roses. When I was eight, Henry helped me build a tree house, out by the lake, in the arms of a huge live oak. He was himself too frail to lift a board or drive a nail, but he had a certain status around about East Point. He could ask the feed store if we might take a couple of fork lift flat off their hands, and so we had some boards to get started. Old Mrs. Dougherty, she donated some really good two-by-sixes to the cause. And Henry knew how to plan things out. He would send me up the tree with a measuring tape, and then we'd sit together with a ruler and a pencil working out the dimensions on a piece of butcher paper. We built the floor first, and a ladder. Then Henry arranged for God to have the East Point Oyster Company to throw out a couple of pieces of fiber-glass corrugated roofing. They set them out by the dumpster just when we could use them. They even set out some boards with molding to fit the corrugations.

Henry lived in a little house that had been meant to be a guest house behind the Mays'. I remember one summer when I used to go over there every evening before dinner, and on the radio we'd listen to *The Shadow*. We were hooked. We'd shoot the breeze for a few minutes afterwards, and then I would run home and make like I was checking up on my parents without them knowing, which was probably pretty close to the truth, though not in any bad way.

On my tenth birthday, I got a water color set for a present. I think it had been sent by my father's aunt. I took it out to the picnic bench, and there was Henry

taking a rest from pruning the roses. Maybe he said something like, "So you got some paints."

Maybe I said, "Yeah."

Maybe he said, "What you gonna' paint?"

Maybe I said, "I don't know."

Anyway, the two of us, we ended up painting roses until dinner. And the next day, I skipped Church and painted Spanish moss and ferns hanging off of trees. Henry showed me how to just use a dot here and a dot there, a wash first and some dry brush later, to not worry about all the details and just go for the feel, to use a little red when you meant pure green and a little blue when you meant just the color of peaches.

I don't remember ever hearing Henry complain about anything. He would talk about being lucky. He'd say, "I'm lucky you got those paints." or "We're darn lucky Mrs. Swithenbank had this box of nails." or "Boy I was lucky that gater wadn't hungry." But I think Henry was lonely at the depths of his soul. I knew about it even when I was a kid, though I couldn't've told you what it was then. We were guys, and we didn't talk about it, but I didn't have any other friends to speak of when I was that age, and when he was that age, he didn't either.

Henry died when I was fourteen, which is probably just as well. He was an old, old man, and if he had lived another year I probably would have found other friends, as in fact I did. It was very sad for me at the time when he died, but the thing that brings a tear to my eye now is all the years before his death when all he had to care for were other people's roses and other people's children. He did a good job at that, but I know he could have handled plenty more.*

October 1999

* A contribution to the *Author-and-Merlin Project*. Paul Wilson, Department of Biology, California State University, Northridge.

Úahlee

Paul Wilson*

He came from over the mountains and beyond, across the badlands. He arrived in the heat of summer with just worn sandals, a tattered tunic, and a water skin. There were some who doubted his story and said he must have come from the North, but he didn't look like a northerner at all, so that didn't ring true.

He was lucky to ask for shelter at my aunt and uncle's. I have two little cousins, Shana who was ten and Isola who was seven. When my aunt had Isola, my aunt was hurt, and the midwife said there would be no more children. After Úahlee arrived, my uncle boasted that his guest must be a very fine hunter to have survived such an impossible journey.

Úahlee did indeed prove himself as a hunter, and very quickly. The first thing he brought home was a string of lizards that he had noosed with a thin braid of his own long black hair tied to the end of a stick. He skinned and roasted the lizards. To be polite, we each tried one. They were very bony but not bad if you didn't think about them being lizards.

Úahlee must have noticed that we didn't consider lizards to be food because that was the last time he brought any lizards home. Next he specialized on rabbits. He made snares out of bits of leather and willow switches, and he brought one or two home whenever they seemed to be called for.

When he first showed up, no one could understand the way he spoke. All his words were different, but not like from up North. To me they sounded flute-like. Some of the words you could tell were the same word, but he said them differently at first. Eventually he learned to speak okay, though even years later he'd mix up words like *of*, *from* and *for*, and if he got upset, he would put all his adjectives before his nouns.

Úahlee was very helpful, really to the point of embarrassing my aunt. He insisted on doing women's work as well as men's. He would go with the girls to gather blackberries and after he saw my aunt making baskets, he had to learn every detail of the process. My uncle didn't mind, though. My uncle and Úahlee got along very, very well. My uncle tried to teach Úahlee everything he knew, and Úahlee wanted to learn everything that my uncle would teach him.

My uncle had always been a bit of a renegade, and he loved having a foreigner for a side-kick. Úahlee's insistence at doing woman work aside, he was a quick study about how to behave. When he first arrived, he didn't know where to sit or even how to sit in a leanto.

He didn't know how to eat in front of people. He certainly didn't know how to dress or groom himself in any but the most outlandish way. By winter, he had figured out all these things so well that my uncle could take him anywhere, and did. They even built a sweat lodge that first winter, and started inviting other men over to sweat and tell jokes. My father visited often, and they all made up stories about fishing the big rivers.

Before he came through the badlands, Úahlee had never fished at all. My uncle and my father took him during the first winter run. Úahlee went back on his own the next week, and perfected his new-found techniques. When they went again the next month, it was like he had always been my uncle's son. They brought back so many fish they fed the whole village.

Úahlee had also never eaten acorn cakes when he first arrived. All fall my mother and my aunt and all of us girls were gathering acorns just like usual, and Úahlee came with us and collected many baskets of acorns. We never thought about telling him about something so obvious as acorns. Finally, one evening when we were carrying our loads back to the leantos, Úahlee couldn't stand it any longer. He asked, "What all many acorns of?" No one understood him.

My aunt said, "Acorns come from oak trees. Each acorn can grow into a new oak tree."

Úahlee said, "Yes. Yes. But what all many acorns of?"

I was the one to realize that he meant, *What are they for?* I explained that they were for eating. It had been so hot that no one had cooked him acorn cakes yet. During the late fall he was very interested in acorns. He helped my aunt crack the acorns and grind them up. He watched her setting them in water and pouring it off later to get rid of the bitter taste, and he learned how to cook acorn cakes on hot, hot rocks.

We all wondered why Úahlee had come to us. No one wanted to ask him though, because we thought maybe he had done something terrible, and we didn't want to put him in an awkward spot. Much later I learned that my uncle had tried to get it out of him, but he said that he didn't want to speak of it. My uncle didn't tell anyone because he did trust Úahlee and didn't want to fuel other people's distrust.

All of us girls, we all had ideas about Úahlee. At the swimming hole, we noticed that not only was he nearly the tallest man we had ever seen, he was also well endowed in another way. We had wondered because, we said, he seemed so "fine-boned". There were arguments about his age. We talked about it so much, I finally asked him. He said he was 22. We girls were surprised, but our mothers were not. My friends and I talked about Úahlee a lot for the first few months, but then for most people the novelty wore off.

It didn't wear off for me. I would take any excuse to go to see my aunt and cousins. Úahlee was sometimes there. He would let me correct his speech

* A contribution to the *Author-and-Merlin Project*. Paul Wilson, Department of Biology, California State University, Northridge.

and ask me about the things I liked. He told me that it was good for him to just listen so he could learn the language. I knew he was trying to be nice, and I let him be that way. In the spring time I learned that he could sing songs. I couldn't understand a word of his songs, but they were very melodic, and I liked them very much. He would sing to me while we made baskets.

Úahlee told me that his grandmother was an herbalist. She had taught him all about herbs for good health and to spice up foods and all about how plants are grouped. He said many of the plants around here were ones he had never seen growing up and didn't know anything about. Many of our plants, though, he knew a little bit about or he knew about their relatives. He would taste them sometimes. He showed me how to look carefully at the flowers and had stories about how the flowers worked. I realized that for all my life I had looked at flowers and never seen very much at all.

Úahlee never touched me that whole spring. Sometimes I would grab hold of his arm, just because it was a little thrilling, or I'd brush him on the shoulder as I walked by. He would smile. My aunt and my mother gossiped about us, but they didn't really discourage it. My father didn't approve, I know, but he held his tongue. Úahlee had spent his winter well, and they trusted him not to do anything untoward. I wanted Úahlee to touch me. I dreamed about it at night. I also savored the way he didn't touch me. He was different from the other boys. I didn't know if it was something special about him in particular or if it was something about where he came from, but he had a way of being considerate even when he didn't know what rules to follow.

He had adapted to our ways in many areas of his persona. In other areas, he stayed the way he had been when he arrived. I later decided that it was because he didn't know how to be otherwise and he never let that stop him. As long as I have known him, he has always been a very brave man, the bravest I have ever known. After he asked to marry me and before I said yes, he told me that the reason he had left his people was because there were too many men of his age. All the girls had been taken as slaves when he had been a young boy, so when he came of age, he said good-bye to everyone in his family and walked into desert to search for love though it meant walking to the ends of the earth.*