

Guest letter from afar: Robinson at the Ninth Parallel
January 2001

Leaving the National Zoo in April was saying "Good-bye to all that" - pace Robert Graves. Since then I've been saying hello again to Panama, and the incomparable Smithsonian Tropical Research Institute. Some of you have visited this jewel in the Smithsonian crown, and know why I can "Go Home Again" even though Thomas Wolfe couldn't.

I first came here in 1965 as a callow graduate student from Oxford. I was to do graduate studies on the famous Barro Colorado Island, BCI to thousands of biologists. There I was to be overawed by a surfeit of sensations--not culture shock but an embarrassment of biological riches. After more than 3 days in transit from London, delayed by engine failure, Wagnerian electric storms, a 7 hour unscheduled stopover in Caracas, and a Paul Theroux rail journey, I was finally there. There on the island that was to become as significant in my life as Shakespeare's "Sceptered Isle" and later, New Guinea. When I finally reached this destination it was around 6 pm, and I was exhausted, a zombie of sleep deprivation. By 6:30 night was falling fast--in the tropics there is little dusk--daylight just switches off. As day ended, someone switched on the mercury-vapor insect light (one emitting a lot of ultra-violet) outside the dining room. On cue came an instant restorative. Insects flew in and landed on the mosquito-screened 'windows'. Some fluttered gently, some zoomed in fast, and some came in like cannon balls hitting the screening with a thud. This was a *nocte mirabile*, the BCI catch was several orders of magnitude more exciting than anything from my temperate-region adventures. The profuse procession of gorgeous beasts generated a living textbook of entomology before my eyes. In 1965 we had not yet invented the word biodiversity, but there it was at the window. I stayed up into the wee small hours, running backwards and forwards, dementedly, from one new discovery to the next, exhaustion and weariness forgotten. My cries of surprise and delight must have amused the blasé BCI residents.

Now I am back again once more sampling the biological *smorgasbord*. Things have changed economically and politically since 1965, but outside my window life is rich. A nearby tree, next to my bird feeder, blossoms red, blue and yellow with birds awaiting my hand-outs. The invertebrates are legion, and a variety of mammals are pedestrians on the greensward. I'm here to study, but I can also experience the delights of a curious naturalist. My research activities include raising web-building spiders from the egg, so that I can have large numbers of adult males and females to study and record their courtship and mating behavior. I'm concentrating on raising two species that I'd encountered here in the sixties and seventies: *Argiope argentata* and *Argiope savignyi*. In both species the large females--the males are very small--have part of their upper abdominal surface a reflectant silver. The spiders have no common names, but *A. argentata* could be called *the silver* Argiope, and *A. savignyi* the *more silver* Argiope.

Their shiny appearance begs the question, what is its function? To develop an hypothesis one needs to know more details of their biology. Rather than give elaborate detail I will skip straight to the nitty-gritty. Web-building spiders usually operate their webs from one of two locations. Many, perhaps most, stand, legs outstretched at the *hub* of their web. The hub is where the silken 'spokes', called radii, converge. Because webs are seldom perfectly symmetrical this part is best not called the web's center. Other spiders monitor their webs from a nearby retreat, such as a curled leaf, or other hide-away. There they can sense web vibrations by grasping a silk signal line attached to the hub. They use this similarly to one using a fishing hand-line. All species of *Argiope* are hub-operators and thus are potentially exposed to both predators and the sun. Web-building spiders have evolved many and complex anti-predator devices in response to this first danger. For me defense is a very interesting subject, certainly worthy of an entire book chapter. On the other hand adaptations for protection against insolation are something I have also studied. Indeed, the golden web spider *Nephila clavipes*, has really complex postural heat regulation. It can aim its long abdomen so as to present the minimum surface area to the sun's rays whatever the apparent position of the sun. By using a mirror I could even 'fool' these spiders about the sun's relative position. Thus I was predisposed to think that the silver might have something to do with heat control (thermoregulation). Using a series of dead spiders, with tiny thermocouples inserted into their abdomens, I was able to show that their internal temperatures rose higher and more rapidly if I painted the silver parts black. This was a crude hint that the silver might be a thermoregulatory device. Of course, the verdict is not proven...but quite likely? I welcome further suggestions on this subject.

Returning to my spider nursery and its maintenance I must say that raising spiders is tedious and painstaking work. The hatchlings are tiny, and have to be placed in separate containers since they would otherwise eat each other. I use transparent plastic half-height 'glasses' with petri dish lids. The baby spiders need live insects as food. So I start them off on fruit flies--*Drosophila* species. Inserting living insects in 180 cages, requires freezing them for just long enough to immobilize them for a few minutes, and then rushing around shaking them into the cages before they unfreeze. As they recover they fly, and, inevitably get stuck to the web in the container thereby stimulating the infant spider to attack. Such feeding becomes a production-line operation as one removes the lids on the first row, shakes in the inert flies, takes off the lids of the next row to cover the processed ones, and so to cage 180. Frenetic stuff! Since males are about one-sixth the length of an adult female and only a tiny fraction of her weight, they mature first. By mid-October I had lots of mature males but the females were more than a month from maturity. I'd miscalculated--goofed, to use demotic English. To remedy this egregious error I sought large, but sub-adult, wild females and raised these to virginal maturity. An *ad lib* diet of stingless bees accelerated their maturation. As a consequence I've recently had weeks of spider sex, in the bedroom, living room and kitchen of my tropical quarters. The apartment is not climate-controlled so I simply allow the spiders to build their webs where they choose. (One is currently above my bed onto which, and also on a sleeping Robinson, it drops the remains of its prey!). The convenience of doing the observations, experiments and video-

taping 'in house' is not to be underrated. No rain delays, easy access to electric power, a concentration of individuals in
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close proximity, and a nearby source of snacks and cold drinks, are obvious advantages of this study site. It also helps to have the peripatetic males loosely confined. The natural ambient temperature and humidity is good for the spiders, but I find the tropical Turkish bath a bit wearying.

As a result of all these observations I've now accumulated masses of video- and audio-tape that I must now analyze and transcribe. I've been able to introduce more than one male to a given female, a situation that could only be found by sheer serendipity in nature, and thus been able to watch for conflict and competition. (The island of Sri Lanka, another favorite of mine, was once known as the Isle of Serendip.) One of the exciting discoveries is that males fight intensively on the female web! Some fights are so frenetic that the participants form a mulberry-like rolling ball with bodies interlocked and inseparable. I know that these studies will help to elucidate questions about female choice, male combat and competition, and post-copulatory male survival, and I am confident that I can now apply the same techniques to elaborate further my previous studies. (I hope to have a research assistant to feed the babies and to avoid the gender generation gap by raising several overlapping families.) The most bizarre -Stephen King-ish- event that I observed during these studies was a strange dismembering of a male. He had successfully courted the female and was copulating when she reached back and seized his abdomen in her jaws. Usually this results in the pair being torn asunder, and the male being in danger but not always killed. However, on this occasion he was rent in twain. The front part of his body, where the intromittent organs are located, remained in *in situ*, legs and all, while his abdomen was consumed. His hemi-corpse blocked the access of a second male that approached a few minutes later. The resulting photograph is grotesque! This blockage was eventually scraped off by the female. In addition to studies of sexual behavior I've also been studying the prey capture behavior of several species of orb-weavers that I'd previously been unable to obtain in any useful numbers. This has proved very exciting. I now know, for example, that butterflies and moths are a special problem for predatory spiders, for these potential prey need immediate restraint to counteract their Houdini-like ability to escape. Only their wing scales stick to the glue on the web and by shedding them the insects can quickly flutter free.

Every day I am now surrounded by exciting experiences, by the glory of biodiversity. The sensory extravaganza includes sights, sounds and odors. I am awakened in the morning (around 6am) by a cacophonous chorus of parrots, more than 150 of which roost in the nearby trees. I recently counted pairs flying home at nightfall across the Chagres river. As they return to their roost they are equally noisy but once each pair has roosted separately (two by two), they engage in calling duets. At night Tungara frogs sing from a nearby swamp providing background noise rather than a lullaby. They chant peow, chuck, chuck when more than three are together. Their songs are punctuated by house geckos that make disapproving tsksk sounds. Other delights abound. One of these is the richness of the bird fauna, a richness of form, color and behavior, not to mention their songs. This morning I put chunks of papaya on my suspended bird

table and 18 birds arrived there within the first two minutes. I've counted more than 20 species, including woodpeckers and strikingly beautiful motmots, feeding on my largesse. There are strange

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dominances that seem to be not entirely a matter of size. Clay-colored robins of the same size and genus as our local ones, are driven off by smaller feisty species! And then there are the mammals. Two days ago an old male coati completed an impossible-looking obstacle course to reach this swinging bird table, driven by inexorable hunger into close proximity with dreaded humans. To reach the food he had to climb up a five foot high metal pipe and then walk an equal distance along a narrow wire. These were acrobatics or gymnastics that filled me full of wonder and sense of discovery. Then I remembered that back in the 1930s Frank Chapman recorded similar coati-ish feats in his book about Barro Colorado, the classic *My Tropical Air Castle*.

So here I am and wish you too were with me to experience this tropical surfeit of the senses, for everyone should be exposed to it to realize what irreplaceable treasures are at stake. It is the focus for insatiable curiosity, a place where questions spring constantly from everyday wonders. We should delight in the extraordinary specializations of plants and animals, and be awed by the capacity of the evolutionary process for fine-tuning. To experience that is as life-enriching as art, music and literature. Hello to all this!

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