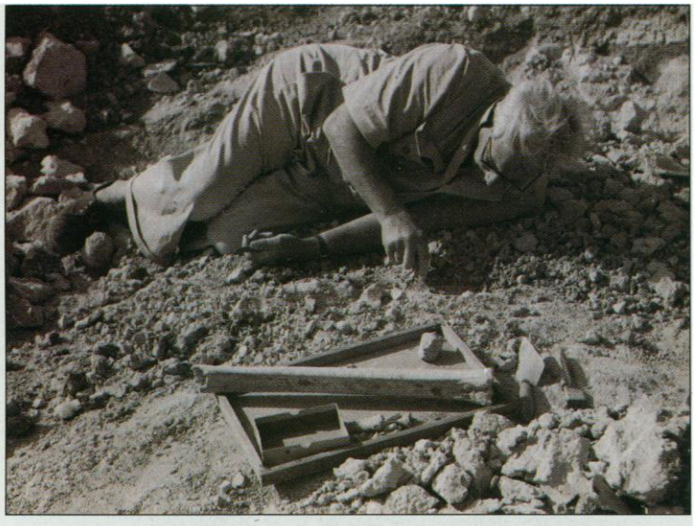
PRIMATOLOGY

Called 'Trimates,' Three Bold Women Shaped Their Field

The researchers' capacity for empathy was key to their findings.

Melissa Remis, a doctoral candidate at Yale University, has just returned from a 3-year study of lowland gorillas in the Central African Republic, a study that involved some terrifying moments. Remis' aim was to "habituate" the gorillas to her presence, persuading them she was a nonthreatening creature, which would enable her to study their normal behavior patterns. But lowland gorillas don't accept strangers easily. The 400-pound males would charge her, screaming at the top of their lungs. In response, Remis crouched submissively and clung to a treetrunk, praying for the courage not to run, which would disrupt months of patient work. "It's like a wall of sound coming at you. You do everything you can to not move. You hold on to the tree, you hold on to your guide [to prevent him from challenging the gorilla], and you say to yourself over and over again, 'Don't move. Don't move. Don't move.'"

Through these ordeals (which happened repeatedly), Remis drew on two sources of inner strength. "I knew that I could do it," she says, "because Jane and Dian had done it before me." Jane and Dian are Jane Goodall and Dian Fossey, who, with their lesser-known colleague Birute Galdikas, are known as the "Trimates," the founding mothers of contemporary field primatology. "Without them, I don't think I ever would have dreamed this big," adds Remis.



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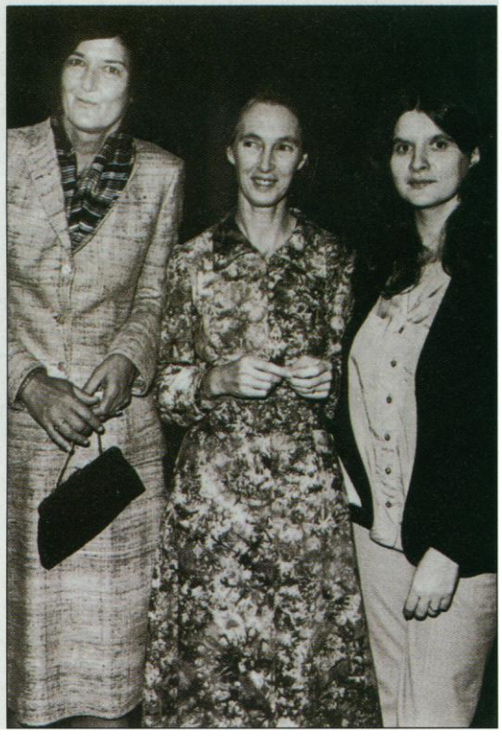


THE LEAKEY FOUNDATION

Finger of fate. Louis Leakey *(above)* picked Dian Fossey *(left)*, Jane Goodall *(center)*, and Birute Galdikas to study great apes because he believed women were more patient and perceptive observers than men.

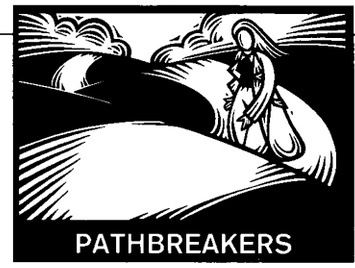
Remis isn't the only one who was encouraged to "dream big" by Goodall, Fossey, and Galdikas. North American primatology, two decades ago a male preserve, is today more than 50% female (see story on page 428). But it wasn't just in numbers that the three women had a huge impact on their scientific discipline. Their methods of living among primates (Goodall with chimpanzees, Fossey with gorillas, Galdikas with orangutans) opened the eyes of their male colleagues. "You have to understand," explains Sherwood Washburn, professor emeritus of anthropology at the University of California, Berkeley, "at that time [the early 1960s] it was not a question of if you had a scientific report, but of whether you could see the animals at all. Before Jane, you were excited even if all you saw was an arm or backside disappearing into the bush. But to sit with the animals, as she did, without them running away, was almost unthinkable."

Using these methods, the Trimates provided groundbreaking insights into the great ape societies—insights some insiders in the field think could not have come from a male approach. In all three cases, the payoff came from the women's capacity to empathize with their subjects, seeing them as individuals whose life histories influenced the structure of the group. At the time, male primatologists were quick to dismiss results acquired by way of this method as female sentimentality. Today, after many battles, the significance of the individual personality in primate groups is taken for granted, and the three women are seen as pathbreakers. "They were the pioneers," says John Mitani, a primatologist at the University of Michigan at Ann Arbor. "And because of that, if you want to study these animals today, you inevitably must look at their research."

Can science empathize?

In the eyes of Louis Leakey, the renowned paleoanthropologist who launched the three women's studies, the Trimates had two important virtues. For one, none of them had much specialized training. "He wanted someone with a mind uncluttered and unbiased by theory, who would make the study for no other reason than a real desire for knowledge," Goodall wrote in *In the Shadow of Man*, her first popular book.

Their second virtue, for Leakey, was their gender. Leakey thought women were better than men when it came to studying wild primates, says Mary Smith, a senior editor at the *National Geographic* who worked



Lone Star State

Mary Osborn's career has been nothing short of stellar, but she's not resting on her laurels. She's fighting to make Germany, her adopted home, more hospitable to women scientists, and she's got her work cut out—because Germany has one of the thickest glass ceilings in European science.

Osborn, 52, is a world-renowned cell biologist at the Max Planck Institute for Biophysical Chemistry in Göttingen. Her pioneering work on cytoskeletal proteins (which help to give the cell its form) has led to new methods for classifying tumors. That work has also made her one of Europe's most frequently cited women scientists in the 1980s, according to the Science Citation Index. In Germany, however, Osborn is a rarity: Though women earn 28% of science Ph.D.s in Germany, they hold fewer than 3% of the full professorships. "Germany is at least a decade behind the U.S.," Osborn says. "And it's improving much too slowly....I've seen that it's not enough not to discriminate. Things won't get better without positive action."

Osborn didn't always think this way. Until a few years ago, she says, she considered gender a "non-issue." Early experiences in her native England prepared her well for life in science, first at a girls-only high school, where "you find out young that you can do science and math," later at the University of Cambridge, where she studied mathematics and physics. "At Cambridge, your grade for the entire 3-year course depends on one set of exams. It prepares you to face any pressure. If you can survive that, you can survive anything."

These confidence-building experiences behind her, Osborn didn't worry about being one of the few women in a nearly all-male community as a graduate student in biophysics at Pennsylvania State University or later as a postdoc in Jim Watson's lab at Harvard. From there she went on to work at some of the world's best labs—the MRC Laboratory of Molecular Biology in Cambridge, England, and then Cold Spring Harbor. It seemed to her that women were being welcomed into science, and she describes those years as "very positive experiences for me." "In those days it was probably an advantage to be a woman."

Osborn retained this optimism when she moved to Göttingen in 1975 with her husband, biochemist Klaus Weber, whom she met at Harvard. Although she saw that women hadn't advanced as far in German science as they had in the United States, she says she "assumed that there was just a lag...one only had to wait and it would get better." Eighteen years later she says: "Time has certainly not solved the problem. Very few women have moved into senior positions."

What's especially frustrating to Osborn is that the male scientific establishment often seems blind to the question of sexism. She points to a 1991 report by the Max Planck Society (MPS), which concluded that the main obstacles facing women in the 64 MPS research institutes are child care and the long working hours. What the report didn't do, she says, is cast a critical eye inward and ask whether the institutes' practice of choosing directors without allowing candidates to apply might exclude women even when no gender bias is intended.


MAX PLANCK INSTITUT FÜR BIOPHYSIKALISCHE CHEMIE

Focus on improvement. Mary Osborn thinks "positive action" is needed to get more women into senior science positions in Germany.

Osborn says that when she raises this question within the MPS, "the standard answer is that 'we appoint based only on merit.' But then you have to question why only 1% of MPS directors are women. Especially in the biological sciences, it's hard to accept the argument that you can't find any other highly qualified women."

It is discussions like these that led Osborn to conclude that the absence of active discrimination isn't enough and that "positive action" is needed. For women scientists to have an equal chance, she says, organizations "must make sure they always ask if women have been properly considered, whether it's for a job, a fellowship, or to speak at a meeting. They should also fund positions specifically designed to increase the pool of women eligible for top jobs. And they should set goals—not quotas—for improving the situation, with a time limit attached. Most important, they must monitor the results."

Osborn is determined to help female scientists in Germany break through the glass ceiling and stay in science, she says, because despite the difficulties, "science can be a wonderful career for women...it's challenging, stimulating...and it can be great fun."

–Patricia Kahn

closely with Leakey and his ape ladies. Leakey, Smith says, "trusted women for their patience, persistence, and perception—traits which he thought made them better students of primate behavior."

Leakey himself was perceptive enough to see those qualities in each of the Trimates, whom he met over a span of more than a decade. Goodall came first, shortly after she arrived in Kenya from England in 1957, aged 24. She contacted Leakey, curator of Nairobi's Coryndon Natural History Museum (today the National Museums of Kenya), on a friend's advice. Leakey offered her a job as a secretary but soon afterward confided that he had bigger things in mind: If she was willing to go, he would find funds to send her to Tanzania to study chimpanzees there. Goodall accepted with alacrity.

In June 1960, she stepped into the forest at Gombe Stream on the shores of Lake Tanganyika, where her determination and skill in watching quickly produced results. Only 3 months into her study, she observed behaviors no researcher had ever reported: chimpanzees feasting on a wild piglet they had killed; chimpanzees hunting monkeys; chimpanzees using tools made from twigs to extract termites from their nests.

That last finding blew apart anthropology's conception of primates—and human beings. "I was at the meeting in London in 1962 when Jane first came back and made that amazing announcement about chimps making tools in the wild," says Alison Jolly, a primatologist at Princeton University. "She essentially redefined what it is to be a human being. We'd all been

No Girls Need Apply

Sometimes in science it can help not to know too much. If you knew eminent scientists had worked on a research problem before—with only limited success—you might justifiably shy away from working on that problem. And that was just what physicist Fumiko Yonezawa didn't know about amorphous materials, better known as glasses.

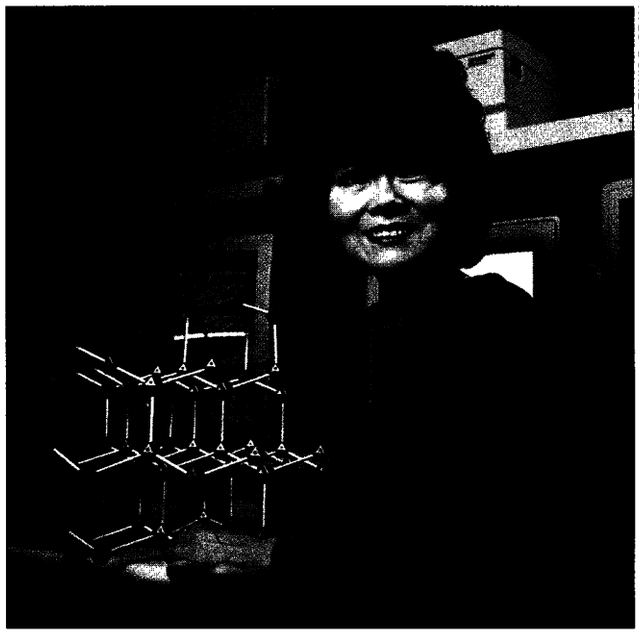
When Yonezawa was a graduate student at Kyoto University, a professor gave her an obscure problem about the statistical theory of random systems. "There were only five papers [on the subject] before that and they had been written by famous people. But I didn't know how famous. So I read them very critically, and I found out what we could do to develop the theory further." The result: a groundbreaking approach called coherent potential approximation, or CPA. That method formed part of her doctoral thesis in 1966 and is now fundamental to the theoretical understanding of the atomic structure of glasses.

Today, Yonezawa is an internationally known researcher who directs a large lab on the Yokomana campus of Keio University. A 10-person team in her lab is pushing beyond the earlier findings to expand the boundaries of computational physics. That team wants to understand, on the atomic level, how liquids become crystals or amorphous solids. "You take elemental atoms, put them in a box, apply pressure, heat, and see what happens," she says, adding laughingly, "It's not easy."

But, then, Yonezawa didn't make it to where she is by the easy route, though she concedes that being a woman has sometimes actually helped. Her work on CPA, begun in graduate school at Kyoto University, came to full fruition in 1967-68, when Yonezawa was at Kyoto University's Research Institute for Fundamental Physics. At the time, CPA was also being developed independently by male researchers at Bell Labs in the United States, as well as in Canada. Among such high-level competitors, Yonezawa stood out. "I think I was lucky to be a woman," she says. "At international conferences there were many papers. When [the physicists in attendance] remembered that a paper was presented by a little Japanese girl, they remembered the work as well."

Yet even Yonezawa, an upbeat person who does not like to dwell on the negative, acknowledges there are major difficulties involved in being a woman in Japanese science. Just as her career was taking off, in 1966, she had a daughter; two more soon followed. "I worked very hard. I had to bring them to nursery school; I had to do the shopping; I had to cook. My husband didn't help me in any way at all. He is a typical Japanese husband," she says. Furthermore, she says, one reason she stayed in academics is that the doors to industry were slammed in her face. Despite being consistently at the top of her university class, "when we tried to find jobs in companies, they all said, 'Only boys, no girls wanted.' Until then I didn't realize I was a girl."

After that kind of reception, she returned to the academic world, spending a few years at Yeshiva University and City College of New York, an experience she says honed her competitive skills in the high-pressure world of American physics. Then she returned to Japan and in 1981 was named professor at Keio University's new department of physics. A share of an unusually large grant of $5 million over 4 years from the Ministry of Education, Science, and Culture powers her lab's work. Recently, as an outgrowth of her interest in computational physics, she has become interested in neural networks.



DENNIS B. GRAY

Model career. Physicist Fumiko Yonezawa uses computational models to study how solids form at the atomic level.

For her success, Yonezawa gives much credit to her mother, who was forbidden to attend university by her father but began teaching Yonezawa geometry when she was still in kindergarten. And she thinks parents generally hold the key to the cultural barriers that exist for women in science in Japan. "Parents say girls are not good at mathematics, and they don't want to spend a lot of money educating their girls in science. I think girls are conditioned since they are very young. Generation after generation has been conditioned like that. It will take generations to correct that."

–Toomas Koppel

brought up on 'man-the-tool-maker' and this just took it apart. Everyone knew that things would never be the same again."

Still, primatology was a bastion of male domination—and Goodall came under attack. The ruling animal behaviorists expected the animals to be numbered and placed in general categories, such as "the male" and "the female." Goodall chose to recognize chimpanzees as individuals instead. "I named the animals and used words like 'individual,' 'emotion,' and 'personality,'" she recalls. That was the key to her method: Goodall watched as life histories unfolded, believing that these lives—rather than theories or experiments—held the key to social structure. "Letting nature, including the animal, go its own way, I think is more female—at least in our society," notes Jolly. "It requires a certain kind of patience to put up with something you can't control."

The leading lights of the field considered this tendency unscientific and sentimental. Like Fossey and Galdikas later, Goodall met with hostility from other researchers. The Trimates "all labored at times under a silent ostracism," says Geza Teleki, a primatologist and the chairman of the Washington D.C.-based Committee for the Care and Conservation of Chimpanzees. "And other times it came right out into the open. There were some meetings where scientists really laid into them in a nasty way, insinuating that what they were doing was not appropriate science."

In time, Goodall convinced other primatologists that what she was doing was indeed "appropriate science"—after she had learned some lessons herself. Says her doctoral advisor, Robert Hinde of Cambridge University: "My role with Jane was to teach her how to do science. Her role with me was to open my eyes to the idiosyncracies of the individuals and to see that these were crucial to an understanding of the animals." Even empathy, the most "female" of traits, came to be seen by male primatologists as an important facet of observing primates in the wild. "Empathy is very important in primatology," says Frans de Waal, a zoologist at the Yerkes Regional Primate Research Center in Atlanta. "It helps you to ask questions and to predict what your animals are going to do."

Most of the remaining scientific critics were silenced in 1986 by Goodall's book *The Chimpanzees of Gombe*. A compendium of 25 years of research, filled with charts and graphs, the book demonstrated that she, too, could make "objective" generalizations about chimpanzees. But the essence of her work remained the perception of individual personalities within the primate group. And some female researchers admire her specifically for persisting in a "female" approach against the discouragement of the male scientific culture. "To succeed at a science, a woman has to do what a man does as well or better; it's why women are very hesitant to approach a field in a more female way," says Barbara Smuts, a primatologist at the University of Michigan, Ann Arbor. "Jane was a sterling exception. She never shied from addressing the chimpanzees' emotional nature, but went ahead and wrote what she saw."

Complex woman

In 1966, when Leakey decided Dian Fossey should be the second Trimate, Goodall was already famous and Leakey was searching for a second Jane Goodall to study gorillas. He found someone considerably more complex psychologically. Fossey, 33, was a physical therapist at a children's hospital in Kentucky who had a passion for African wildlife. Approaching Leakey after a lecture at the University of Kentucky at Louisville, she convinced him she was a worthy successor to Goodall.

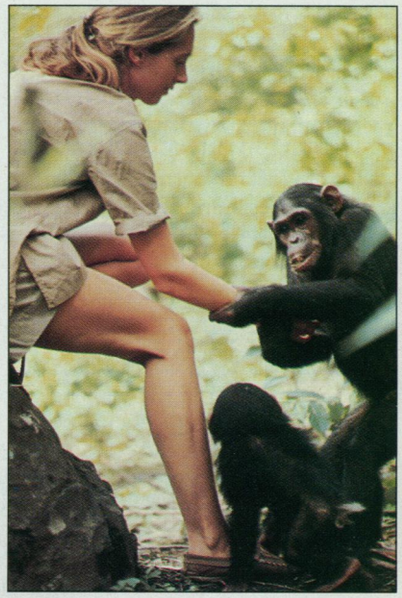
Eight months after that meeting, with funds from the Wilkie Foundation (which had also sponsored Goodall), Fossey was on her way to the Congo, where she encountered disaster: Her study was disrupted by civil war, she was taken captive, held in a cage for public display, and may have been raped. Undaunted, Fossey set out again, this time for Rwanda, where she established the Karisoke Centre for Mountain Gorilla Research. Though she did not witness behaviors as sensational as those Goodall reported from Gombe, Fossey saw things primatologists had never viewed: female gorillas transferring between groups; males killing infants to bring females into heat; gorillas eating their own dung to recycle nutrients.

Those findings formed the basis for Fossey's 1976 Cambridge dissertation, written, like Goodall's, under Hinde. Because so little was known about the gorillas at the time, her dissertation "really established the baseline" for primatologists' understanding of the species, says George Schaller, an eminent zoologist who in 1959 made the first study of wild mountain gorillas. Adds Phyllis Jay Dolhinow, a biological anthropologist at the University of California, Berkeley, "She contributed a vast amount of information about what was largely an unknown ape. Her paradigms were not fashionable, not quantitative, but that's okay. She was an accurate reporter and reported it well."

For Fossey, as for Goodall, the individuality of the apes was paramount. At Cambridge, Fossey forced herself to fit data into the required statistical format, but it was an excruciating experience, and after her thesis she wrote only four scientific articles. Instead of observing objectively, Fossey, whose own human contacts were tenuous, plunged further into the life of the gorilla band. By the end, she had so thoroughly habituated the animals by imitating their behaviors that she was able to sit among them as if she were a gorilla.

This integration into the gorilla group is a direct outgrowth of the empathy that made Goodall's and Fossey's work possible. But as Fossey crossed the line from dispassionate observer to participant in gorilla social life (tickling infants, letting the gorillas rummage in her belongings and groom her), she grew less interested in science. The final straw for her was the fact that the gorillas (then numbering only 250) were in danger of being wiped out by poachers and civilization itself. Analyzing age groups, mapping the animals' ranges, sampling dung, listing preferred foods —all work Fossey had done—seemed pointless when the gorillas themselves were in danger of disappearing.

Ultimately, Fossey gave up data collection altogether for what she termed "active conservation": patrolling the park for snares and poachers. Research assistants at her camp who did not follow suit were belittled. Says Kelly Stewart, a primatologist at the University of California, Davis, who worked with Fossey at Karisoke, "If anyone did anything other than going out on anti-poaching patrols, she labeled them as selfish. And compared to her, other people *were* more interested in their



BARON HUGO VAN LAWICK © NATIONAL GEOGRAPHIC SOCIETY

ROD BRINDAMOUR

RICHARD WRANGHAM/ANTHRO-PHOTO

Trimates and their primates. Goodall *(top)* studied chimpanzees Galdikas *(middle)*, the organgutan, Fossey, mountain gorillas. In each case the women were able to accustom the apes to their presence.

A Prize of One's Own

"There are a lot of reasons why women don't go into science," says Japanese geochemist Katsuko Saruhashi. "The lack of equal opportunity is one. There is also the attitude of society, of parents and teachers. And there is little recognition of the contributions of women scientists." Saruhashi, 73, retired from government service after a distinguished career as a marine geochemist, is fighting a two-front war against these obstacles.

In the first place, her own career is an example of the contributions female scientists can make. She published some 80 papers, analyzing CO_2 in seawater long before it attracted international attention as a key greenhouse gas and studying the effects of fallout from atomic bomb tests on the atmosphere and oceans. She is also trying to redress the lack of recognition for women in science through the Saruhashi Prize, which she established in 1981 and is given each year to a woman who can serve as a role model for young female researchers.

Clearly a role model herself, Saruhashi was an undergraduate at Toho University during World War II, when university labs were short of equipment. One of her professors introduced her to Yasuo Miyake, a government meteorological scientist, who arranged for her to use government lab facilities. Miyake became an important mentor. "He didn't care if it was a man or a woman," Saruhashi says. "If a researcher had drive, he would do as much as he could for them."

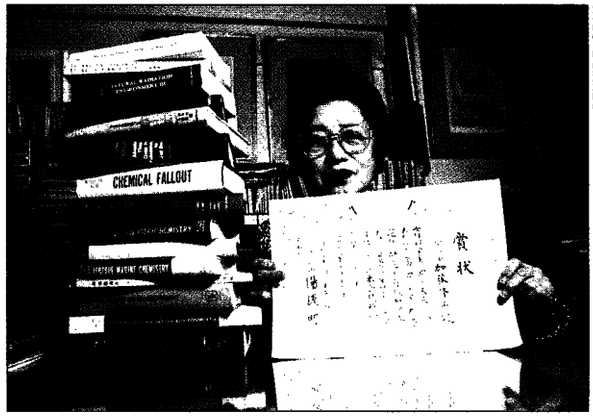
When she graduated, she asked for and received a position on Miyake's research team. "At that time, women science graduates generally became secondary school teachers," Saruhashi says. "I wanted to do research. I met just the right scientist to help me get started." After the war Miyake set up the Geochemical Laboratory as a part of the Transport Ministry's Meteorological Research Institute, and Saruhashi went with him.

There, in about 1950, Miyake suggested Saruhashi investigate the behavior of CO_2 in seawater. "Now everyone is concerned about carbon dioxide, but at that time nobody was," she says. "At that time it was difficult. I had to begin by developing methods of measuring CO_2 concentrations in seawater and how they varied by location and depth."

Just as that painstaking work was acquiring momentum, Saruhashi was diverted by the Bikini atoll hydrogen bomb test of 1954. When the crew of a Japanese fishing trawler downwind of the test site fell ill from radiation sickness and one crew member died, the Geochemical Laboratory set up monitoring stations throughout Japan. Saruhashi says they were the first group in the world to begin research into how radiation from Bikini, and other U.S. and Russian test sites, was dispersed in the atmosphere.

Perhaps even more than for her own work, Saruhashi's name is becoming known for the prize, given annually to a Japanese woman 50 years old or younger who has made significant contributions in the physical sciences. "I wanted to highlight the capabilities of women scientists," Saruhashi says. "Until now, those capabilities have been secret, under the surface."

In line with Saruhashi's interest in broadening recognition of female scientists, recipients get more acclaim than cash. There is a cash award, but at $2,400 (¥300,000) it isn't in competition with, say, the Japan Prize. "We thought it would help pay the way to a conference overseas," Saruhashi says. "It would be nice if it could be larger, but the fund is pretty small." (Funding comes primarily from Saruhashi and her friends.)



DENNIS B. GRAY

Glittering prize. Katsuko Saruhashi with the certificate of the prize she established for Japanese women scientists, 50 or under, who can serve as role models for younger researchers.

Saruhashi, who is managing director of the Geochemistry Research Association, set up by Miyake to disseminate information on issues in geochemistry, is also receiving some recognition of her own. This June she is due to receive a meritorious service award from The Society of Sea Water Science in Japan. True to her pathbreaker's nature, she will be the first woman to receive the award.

–Dennis Normile

Dennis Normile is a Tokyo-based science writer.

own research and less in the conservation. But that was her whole life."

In 1977, poachers killed her favorite gorilla, Digit. "That tragedy practically unhinged her," says Mary Smith. "She became dangerous to herself and the Rwandans, because of her volcanic temper and her methods of interrogating alleged poachers." In 1979, the Rwandan government asked her to leave the country. She returned in 1983 only to be murdered at Karisoke by an unknown assailant 2 years later.

If Goodall's story raises the question of whether empathy can have a role in science, Fossey's raises the issue of what values scientists heed. Many studies have shown that a key difference between men and women is that men often place a high value on theoretical values —knowledge for its own sake—while women tend to evaluate knowledge according to its usefulness (see story on page 409). In Fossey's case, the two types of values were intertwined from the beginning—since her scientific interest in the gorillas was triggered by a passion for wildlife and a desire to make a difference in the world.

Ultimately, her concern for the gorillas overrode her scientific values—an experience not uncommon among field primatologists, who often study endangered species. "It's the current dilemma for many scientists: whether one has the obligation to do something useful for the world or to remain purely theoretical," says Teleki. Adds Schaller: "Whether or not one approves of her methods and her goals, Fossey was the one who made the world aware of the plight of the gorillas. Her commitment was critical to their survival."

Publish or perish?

In some ways Birute Galdikas had the most difficult scientific task of the three Trimates. Unlike chimpanzees or gorillas, orangutans are solitary creatures; ob-

serving their interactions is an exceedingly tricky business. Not only do the animals seldom mingle, they live high in the trees and rarely descend to ground level, which is often a swamp. It wasn't until Galdikas had been in the rain forests of Indonesia for a week that she saw her first orangutans, a mother and an infant. The apes were high overhead in the forest canopy. "To follow them, you would have had to just jump in the swamp, which was neck-deep there, and that's when I thought, 'Gee, this is going to be really hard.'"

But Galdikas had time and patience—and a passion for studying wild orangutans. She had nurtured that dream long before she met Leakey, in 1969, when he delivered a lecture at University of California, Los Angeles (UCLA), where she was a graduate student in anthropology. Galdikas approached him after the lecture, and her enthusiasm made it clear to him that she deserved a place in the lineage founded by Goodall and Fossey. It took Leakey some time to raise funds, but he ultimately secured enough from several sources to send Galdikas and her then-husband, photographer Rod Brindamour, on their way to Indonesia's Tanjung Puting reserve.

Once there, it wasn't just the solitary nature of the orangs that made study difficult. Orangutans lead slow-paced lives: Females are 15 before they bear their first infant—making a mockery of rapid publication. And the apes didn't welcome her. Instead, they hurled branches and defecated on her when she approached. But Galdikas wasn't in a hurry. "I never pressed them," she says. "I would stop so that they would see that I was not really dangerous, and the next time they would be more relaxed." Nevertheless, it took 12 years for her to habituate one of the orangutans to her presence.

As it had been for Goodall and Fossey, the scientific payoff from Galdikas' patient effort was substantial. The most academically oriented of the Trimates, Galdikas did not shy from modern data collecting techniques or statistics, drawing on those for her highly praised 1978 doctoral thesis from UCLA. In the thesis Galdikas recorded interactions quite different from the little that was then known about orangutans. She saw adolescent orangs traveling together; subadults sometimes forcibly copulating with females; and males and females spending time together in lengthy consortships. She also packed her doctoral study with statistical correlations, identified the orangs' calls, and catalogued every plant and insect they ate.

That would seem to be a highly promising start for a scientific career, and Galdikas' research could easily have led to a traditional university position; but this was not her goal. Though she has part-time appointments at Simon Fraser University in Vancouver, British Columbia, and at the Universitas Nasional in Jakarta, Galdikas' career is—like those of Goodall and Fossey and some other women scientists—more maverick and marginal than those of many male researchers. Like Fossey, Galdikas has grown increasingly concerned with conservation, and now runs her research center, Camp Leakey, primarily with the aid of Earthwatch, the conservation group, rather than with funding from mainstream scientific organizations.

Yet that hasn't been entirely by choice. Scientific funding agencies have become reluctant to support her work because in recent years she hasn't published much—and what she has published often relies on data that was collected during her first years of study. "I always support her grant applications," says Peter Rodman, a biological anthropologist at the University of California, Davis. "But there are many things about the life histories of these animals that we'd like her to share. We really haven't heard about them since her thesis." That kind of complaint angers Galdikas. "Those who say I haven't published haven't been in the swamps up to their armpits. Besides, it shouldn't be the quantity of papers, but the quality," she adds, noting that her recent study of birth intervals among the orangutans is highly regarded.

Galdikas' retort—that quality is more important than quantity—is one that may reflect deep-rooted differences in how male and female researchers approach science. Several studies have shown that women publish fewer scientific papers than men do (see story on page 384), and although there are differences of opinion about why that is so, many female researchers—and some males as well—believe it is because women are more concerned with thoroughness and with justifying each publication than with the overall number of their publications.

ANTHRO-PHOTO

Galdikas' scientific trajectory, like that of Fossey and Goodall, may also reflect another key difference between men and women in scientific research. Males, conditioned practically from birth to think of themselves in terms of career success, bring those expectations to science. They tend to evaluate research topics, collaborations, and jobs in terms of rapid career payoff. It is unlikely that a promising young male researcher would have been willing to invest 12 years habituating a single orangutan, because of the risk that, if there weren't a huge payoff, his career would be in ruins. Galdikas' slowness in publishing—in fact, her overall indifference to conventional academic standards—is what made her scientific success possible.

The female style

The question of whether the successes of Jane Goodall, Dian Fossey, and Birute Galdikas were due to their gender is not easy to resolve. It may be tempting to think, with Louis Leakey, that females are patient and singularly perceptive observers. Yet that point of view may simply reflect his own male biases. The qualities the Trimates showed in the field might have had more to do with being scientific outsiders than with being women.

No matter which is true, the Trimates have had an enormous impact on the field of primatology. Not only have they spawned a vast number of students who went on to become major players in primatology, their early studies provided the core of what is known about chimpanzees, gorillas, and orangutans. Perhaps most important, says George Schaller, the Trimates taught science that the great apes are "true individuals." Says Schaller: "They have given us an empathy with our closest relatives, and that is the only thing that will save these animals in the end."

–Virginia Morell

"To succeed at science, a woman has to do what a man does as well or better; it's why women are reluctant to approach a field in a more female way."

–Barbara Smuts