Major Grant From Apple Computer

A score of tasks at the Institute—from analysis of scientific data to management of membership lists—are going more smoothly now, thanks to a major grant in kind from Apple Computer Inc.

Apple has donated to the Institute two Macintosh IIs, six Macintosh SE's, two modems, a Laserwriter and an LQ Imagewriter printer, together valued at just under $50,000. One of the Mac IIs, for use in the Berkeley Geochronology Center (IHO's radiometric dating facility), is equipped with a color monitor and 5 MB of internal RAM.

Apple's contribution was augmented by grants in kind of software and equipment from several other firms: Farallon Computing (network connections), Bob Bianco Sales (surge suppressors), Olduvai Corp. (desk accessories), TOPS (networking software), MicroMaps (software), Monogram (software), and Microsoft (integrated word processing, spreadsheet and data base software).

The computers began arriving in early March, and the network was fully functioning by the end of April.

The Apple grant stemmed in part from a visit to IHO last autumn by two of the company's top executives, Jean-Louis Gasse, vice president/research and development, and David Barram, vice president/administration. They were especially interested in the pioneering programming work done by BGC scientists in computer monitoring of the radiometric dating process.

The new computer system not only facilitates many current operations at the Institute, but also holds great promise for the future. Plans include development of a comprehensive data base indexing many thousands of books, journal articles and monographs bearing on human evolution, for use of scientists worldwide and eventually for the interested general public as well. Institute scientists also hope to obtain Mac SE's for use in Tanzania and Ethiopia, thus making it easier to share data with their African colleagues involved in collaborative field and laboratory studies.

From Chickens to Windmills

Before Dr. Gerald Eck left California for Tanzania on May 24, he had to pick up a few items still on his shopping list—including 150 packets of Kool-Aid!

Dr. Eck, an IHO Scientific Associate and an associate professor of anthropology at the University of Washington, is the person who organizes and oversees the practical details of the Institute's field work at Olduvai Gorge.

From buying live goats to keeping windmills in repair, he makes sure that the scientists investigating the Gorge aren't distracted by hunger, thirst, vehicle breakdowns or power outages.

His approach, in fact, is to make life as comfortable as possible when the "corner store" is a day's drive away.

"We don't rough it at all when we're at Olduvai," he explains. "At the least, we should eat as well as we can. We're there to get work done, not to play cowboy—that just wastes energy better spent on working."

So where does the Kool-Aid come in?

Coffee, tea, and just plain water get pretty boring after several weeks in the field, Eck explains, while American-style soft drinks are hard to obtain in Tanzania and bulky to transport. The solution—Kool-Aid.

In fact, Kool-Aid is only a minor item in a major grocery list for the Olduvai field season—enough to feed 25 to 30 people for six to ten weeks. Eck's purchases this summer will include hundreds of pounds of sugar, rice, white flour (for bread), jam, margarine, coffee, tea, cooking oil, and soap powder, all bought at the beginning of the season in Arusha, the nearest town of any size. While he's in Arusha, he will also buy many drums of petrol for the expedition's Land Cruisers, along with 20 to 25 live chickens that will provide anthropologists' dinners during the season.

These supplies need to stretch for the full field season, since it's a two-day journey from Olduvai Gorge to Arusha and back. They will be supplemented, though, by a shopping expedition every couple of weeks to the nearest market at Mto Wa Mbu ("Mosquito River"), a mere 15-hour round trip over very rough roads.

Although Mto Wa Mbu is a far cry from a supermarket, it does offer fresh produce—cabbage, tomatoes, carrots, bananas, oranges and eggs. Cabbage, incidentally, is bought in preference to lettuce because it keeps better.
Director's Report: In Search of the

In a little more than two hours, we had climbed 2,000 feet, following our trackers up the muddy, nearly vertical trails through almost impenetrable mountain forest and through a steady downpour. A misstep off the narrow path and you slipped down 15 feet, crashing into a tree or, even worse, a patch of stinging nettles.

Now we were above 1,000 feet on the treacherous slopes of the Virunga Mountains, and, we hoped, close to our goal: the Mountain Gorillas.

We had passed through the tranquility of a bamboo thicket, with its special greenish glow, when our guides spotted fresh gorilla dung. In French, they cautioned us to remain still and quiet as two of them pressed further into the forest. Now we were off the trails and venturing into the unknown. Using pangas (machetes), our trackers slowly and carefully cut a trail through the tangled brush, providing only enough room for us to crawl on our hands and knees.

The rain was letting up and, as we broke into a clearing, my heart skipped a beat. What I saw first was just the dense vegetation moving, but then I discerned a large black form—my first gorilla! I had never before seen an ape in the wild, and I let out an audible gasp as I looked into its brown eyes.

Our group was careful to follow the guides’ instructions: to crouch and not to make any sudden moves which might threaten the gorillas. None of us were in any mood to confront a 400-pound, 6-foot-tall silverback male.

As thick clouds returned and the downpour began again, the gorillas cowered under the dense, dark green vegetation, occasionally looking nervously in our direction. Their thick black hair glistened, and they were surrounded by a cloud of steam coming from their warm bodies.

The gorillas were unhurried about the rain, and our presence made them even more uncomfortable. Slowly, one by one, they retreated, disappearing into thick underbrush where we could not follow. Our first day of gorilla tracking was over.

I had brought a group of ten Institute members to Rwanda on an Abercrombie & Kent, Ltd. safari to view the Mountain Gorilla, Gorilla gorilla beringei, in its natural setting. We were visiting the Parc National des Volcans, dominated by seven dramatic extinct volcanic peaks on the border between Rwanda and Zaire. This was Africa’s first wildlife park, established in 1925. Gorillas are of great interest to anthropologists because we know that they are very closely related to humans. In fact, genetic studies have revealed that we share nearly 99% identity with this ape in our genetic make-up.

I always had a great desire to see gorillas in the wild, and I will always regret not accepting my friend Dian Fossey’s invitation to visit her research camp at Karisoke. Dian had worked for 18 years in the Virunga volcanoes before her tragic death in 1985. I believe that had it not been for her continuing efforts, these gorillas would have become extinct through poaching and the encroachment of expanding farmland.

Rwanda is Africa’s most densely populated country, with a population of about 6.5 million in an area the size of Maryland. One can understand why the economics of feeding so many people would far outweigh the preservation of the gorillas.
Mountain Gorillas

But Dian didn't see it that way, and her heroic efforts convinced the Rwandan government of these creatures' great importance. From 1960 to the late 70s, the gorilla population dwindled from 450 to less than 200. Today, however, their numbers are actually increasing, due to concerted conservation efforts.

The Rwandans toast the gorilla everywhere — there's even a gorilla face on the local currency when you arrive at Kigali Airport.

On our second day of gorilla viewing, we set out at dawn, assembling at the guide post and collecting walking sticks to assist in the climb. As they had the day before, our trackers carried rifles — not for defense against the normally gentle gorillas, but for dissuading an angry Cape buffalo from charging our group.

The weather was kinder that day, warmer and with little rain. However, the dry atmosphere encouraged the stink bugs, the army ants, to be more adventurous. On more than one occasion someone would stop, drop everything, and practically disrobe in an attempt to brush off the stinging ants.

After roughly two hours of climbing, we encountered a dozen gorillas and pursued them into the dense and tangled brush. Finally we entered a more open area where the gorillas were ending their morning feeding period. A large silverback male named Mulizi kept a close eye on his group as well as on us. For reassurance, I made "contentment" grunts, which were answered by the gorillas themselves.

As we watched, the apes continued to feed causally on leaves, wild celery, bamboo, and tubers. Some were beginning to relax and rest as they customarily do in the middle of the day. The young ones remained very close to the females, frequently in body contact with them. Mulizi frequently turned to glance at us, repositioning himself as if to alert us to his readiness to move should he be provoked.

At one point I was so intently observing the gorillas interact with each other that I didn't realize a young female was pushing past me to reach an especially succulent plant. Not until I felt a foot on top of my own did I turn to see who it was — and realized that it was a gorilla!

As we watched, young males practiced chest beating, a threat behavior common in gorillas. One little guy was so enthusiastic that he fell over, to his own great surprise.

At another point, a female let out a sharp vocalization. This alerted the silverback male and sent him charging directly toward one of the safari members, who immediately fell to the ground. The 400-pound creature reassured the female and slowly returned to his feeding place. My safari companion, greatly relieved, sat up smiling.

Our allotted hour was over before any of us realized the passing of time. No one wanted to leave, but park officials have established strict rules designed to prevent interference with the gorillas' daily routine. So we moved slowly away, turning our heads for a last glance at one of our closest living relatives.

Bruce Schnitzer joins Board

Bruce W. Schnitzer of New York City, a merchant banker who has given organizational and financial help to IHO projects since 1986, has joined the Institute's Board of Directors.

Mr. Schnitzer is vice chairman of BEI Holdings, Ltd., a consulting firm which serves approximately 300 banks and thrift institutions, and a principal stockholder of Bayly, Martin, & Fay International, Inc., a privately owned international insurance broker. He was president of Marsh & McLennan, Inc., the world's leading insurance broker, from 1983 to 1985, and before joining Marsh & McLennan, was vice president of Morgan Guaranty Trust Co.

Mr. Schnitzer's interest in the scientific search for human origins was aroused by travels to East Africa. His association with Institute activities began in the mid-80s when he learned, through IHO Board Vice President Thomas F. Hill, of the need to underwrite the animation of David Smeltzer's award-winning film, Lucy in Disguise.

In 1986 and 1987, Mr. Schnitzer worked with Tom and Kelly Hill to organize the Institute's annual awards dinners in New York City. He also helped to provide funding for the Institute's field work in Tunisia last year.

Bruce W. Schnitzer

Windmills

Continued from page 1 and can be served either raw or cooked. Nonetheless, Eck says, members of the expedition develop a real craving for fresh vegetables after a steady diet of camp cooking.

While at the Mto Wa Mbu, expedition shoppers also stock up on maize — generally 200 pounds, or "as much as will fill the Land Cruiser." The maize is given to Maasai tribespeople near Olduvai Gorge in exchange for goats, thus helping to solve another dietary problem at the camp, a lack of fresh meat. The Maasai usually supply about five goats per season; when the chickens and goats run out, camp cooking relies heavily on canned corned beef.

Although Eck is the expedition's main grocery shopper, he doesn't plan the menus in detail. That's done by the camp's head cook, usually hired in Arusha at the beginning of the season, along with two helpers. Wives of year-round Olduvai Gorge workers are hired to help with dish washing and laundry.

Food is not, of course, the only thing on Eck's mind as he organizes a field season. There are, he says, "a million different things. For instance, vehicles must be maintained and insured — that can be a nightmare — and this year we have to rent a lorry.

"Also this year, we're repairing the electrical system, with funds from a grant by Mr. Gordon Hanes. I've hired a UC Berkeley student to do the repair work in exchange for his expenses."

Electricity is supplied by two wind-driven generators, enough for lighting but not refrigeration. Since Olduvai Gorge is located close to the equator, the sun goes down promptly at 6:30 each night, leaving the camp in darkness. With the electrical system in disrepair, the expedition resorted to gas lamps.

"But it's difficult to buy fuel for those lamps in Tanzania," Eck says, "so we'd have to use nasty, smelly kerosene lamps."

Since anthropology departments don't offer classes in the practical details of field work organization, Eck learned his techniques on the job. It began rather innocuously in 1968, with Dr. Clark Howell (now professor of anthropology at UC Berkeley) in Omo, Ethiopia.

"We were getting ready for the field in Nairobi, Kenya," Eck explains, "and I asked Frank Brown, a student geologist who was organizing the expedition, what I could do to help. He told me to go pack the lorry."

The following year Eck took the Olduvai expedition to the field with Brown's help, and for the following two years, he was in charge. The organizing expertise he gained in those years is being put to good use now at Olduvai Gorge.
Behind the Scenes: A Look at the Institute Laboratories

Let's take a look inside the casting lab, part of the Institute's Erma and Farley O'Brien Paleanthropology Laboratories. Here technicians and volunteers create molds—two-part, three-dimensional negative images of fossils—from a rubbery substance called silastic, and casts, exact plaster replicas of those fossils.

The work is directed by Michael T. Black (shown working on a plasticine form for a mold in photo 1), a University of California anthropology student assisted by Hilary Wright and several volunteers.

The first step in making a cast is measuring and thoroughly mixing dental plaster with a gypsum hardener, forming a thick, cream-colored liquid (photo 2). This mixture is drawn (photo 3) or poured into a syringe, then injected into each half of the mold (photo 4). The mold here rests on a vibrating base, one of several precautions to ensure that no tiny air bubbles are trapped in the cast. The technician may also use compressed air to blow the mixture into each nook and cranny of the mold.

Now comes one of the most critical steps in the process—closing the mold. The technician balances one half of the mold on his or her right hand, the other half on the left, then brings the two halves of the mold together smoothly, with no sideways slippage. The mold, in its plaster jacket, is strapped together with tape, any bits of the plaster which have oozed out are washed away (photo 5), and a weight is placed atop the mold until the cast sets.

The moment of truth—the two halves of the mold are peeled away from the hardened cast—a near perfect replica of the original fossil (photo 6). Completed casts show in the background. The finished cast may later be painted to resemble the original.

Photos by Sylvia Hixson and Dixie M. Jordan

Cleaning a Fossil Cranium

Let's follow the monkey cranium shown on page 1 from its discovery in Olduvai Gorge last summer to its present condition—cleaned and ready for paleoanthropologists to study in detail.

The sharp eyes of Mrs. D. Tillya, a Tanzanian member of the 1987 Tanzania Institute joint expedition to Olduvai, spotted just the tips of the enormous upper canine teeth protruding from hard sediments in the Gorge. Team members excavated a large chunk of the surrounding rock and jacketed the chunk in plaster for shipment to the Institute's Berkeley laboratories; they did not attempt any further work on the fragile fossil in the field.

Because the cranium was found in situ—embedded in sediments, not eroded out and lying on the surface—it was possible to make a very close estimate of its age. This specimen came from upper Bed II, making it approximately 1.3 million years old.

Back in Berkeley, Dr. Gerald Eck, an IHO Scientific Associate and a specialist in the evolution of African monkeys, went to work.

At this point, the cranium was completely encased in plaster and in a very hard matrix of limestone and clay-like mud. Eck used first a miniature jackhammer to remove the outer casing of rock. As he came closer to the surface of the fossil, he switched to another specialized tool, a micro-sandblaster that emits a fine spray of ground glass. The work was done under a microscope and under the hood of an Airbrasive system, which employs a vacuum to whisk away the quantities of dust produced during the cleaning.

In this particular case, it was relatively easy for Eck to distinguish the fossil itself from its rocky matrix. The limestone was cream-colored, the mud olive, while the bone was a light chocolate brown. Often, though, scientists must study the specimen they are cleaning under a microscope to detect subtle differences in texture between fossil and rock.

As Eck reached the fossil's surface, it became apparent that the cranium was shattered into many, many pieces, held in place only by the matrix. He impregnated each part of the skull with a polyvinyl acetate glue as it emerged. This hardened and held each of the fragments in place, so that the cranium emerged from its cleaning intact.

The final result was a nearly complete cranium of *Theropithecus oswaldi*, a close relative of the modern gelada baboon. The canine teeth identify this specimen as a male, significantly larger than any living baboon—perhaps the size of a Great Dane.

This species lived throughout Africa, and probably eastward to India as well, from about 2.3 million to 300,000 years ago. It became larger and larger over the years, with late specimens almost as big as a modern gorilla.

A fossil such as this helps paleoanthropologists to reconstruct the environments in which our ancestors lived. *T. oswaldi*, for instance, was probably a ground-dwelling monkey which lived in a grassland habitat—thus providing a clue to the environment at Olduvai Gorge 1.3 million years ago.
Orangutans

If you think some males never grow up, you may be right—especially if you’re talking about orangutans.

Dr. Peter S. Rodman opened the Institute’s 1988 spring lecture series for the general public with a look at the two distinctly different forms of male orangutans, the so-called “adults” and “subadults.” The forms differ from one another so dramatically, in fact, that one 19th-century scientist was tempted to classify them as separate species.

Although the term “subadult” seems to imply simply a stage on the road to full maturity, that’s not necessarily the case with these great apes of Southeast Asia, Rodman said. Scientists have observed some male orangutans who have remained “subadults” for as long as 14 years. Others are known to be fertile and to have fathered offspring. It’s possible that these males have adopted an “stable alternative strategy” rather than just waiting for adulthood to arrive.

Rodman, professor of anthropology at the University of California, Davis, has studied the behavior and ecology of orangutans extensively in Borneo and Sumatra.

The early life of all male orangutans is much the same, Rodman said. For their first half dozen years or so, the young apes remain close to their mothers. As they reach subadulthood, around age 8, they leave their mothers and often travel long distances. At this stage the male’s testicles are completely descended, his beard starts to develop, and he weighs 30 to 50 kilograms—about half the weight of a fully mature adult male.

At about age 13, some males begin their development to full maturity, a change which can happen in less than a year. The fully adult male will have prominent cheek pads, throat pouch and beard, long thick hair, a musty scent, and very large body size (although not as heavy as the grossly overweight males seen in zoos).

Other males will simply remain in the subadult form for many more years.

The differences in behavior between the.

Continued on page 7

Olduvai Gorge Field Season

Institute scientists and their Tanzanian colleagues are continuing their survey of Olduvai Gorge this summer, looking primarily for hominid fossils and artifacts.

Field work is scheduled to run from mid-June to the end of August.

In the past two years, team members have surveyed about half of the Gorge and discovered several hominid fossils—the most spectacular being OH 62, a Homo habilis (“handy man”) partial skeleton found in 1986. Although they will not finish the survey this field season, institute scientists expect they will have looked at about 90% of the most promising areas by the end of summer.

Another goal for this year is to develop a map and rough schedule for on-going work in future years, when Tanzanian team members will look regularly for newly eroded-out fossils. Some portions of the Gorge will need to be checked annually, others less frequently.

At nearby Laetoli, Prosper Ndessokia, a Tanzanian graduate student in vertebrate paleontology at the University of California, Berkeley, will continue a survey of 2.5 million-year-old sediments he began last year.

The Institute team at Olduvai Gorge this year will include Dr. Donald C. Johanson, IHO director; Dr. Gerald Eck of the University of Washington Anthropology Dept.; Dr. Robert C. Walter, a geologist from the University of Colorado; Dr. Robert Blumenschine, an archeologist from the State University of New Jersey at Rutgers; and students Michael Black, Hilary Wright, and Stewart Patrick.

Tanzanian participants will include Dr. Fidel Masao of the National Museums of Tanzania, co-leader of the expedition (with Dr. Johanson) and head archeologist; Dr. C. Magori, a physical anthropologist from the University of Dar es Salaam; Paul Manega, a University of Colorado graduate student; Prosper Ndessokia and Pelaji Kyauka, University of California, Berkeley, graduate students; D. Tillya, S.O. Minazi, S. M. Kamenya, C. Saanane, and O. Kyara, survey team members from the Tanzanian Antiquities Section; and A.K. Juma, a student from the National Museums of Tanzania.

The field season was preceded by a meeting of the Olduvai Research Group, the joint Tanzanian-American team working at Olduvai and Laetoli, to discuss goals for Tanzanian paleoanthropological research at those sites.

Attending were Dr. Johanson; Dr. Masao; Dr. Eck; Dr. Walter; Dr. Blumenschine; Dr. William H. Kimbel, assistant director of IHO; Dr. Tim White of the University of California, Berkeley; and Tanzanian graduate students Paul Manega, Prosper Ndessokia, and Pelaji Kyauka.
Book Reviews

Ecologist Michael Ghiglieri flew to Uganda in December 1976 with a specific mission in mind. Unlike other students of the common chimpanzee, Pan troglodytes, he decided not to entice his subjects into the open with food or to interfere with their social interactions in any way. Those who knew the chimps of the Kibale forest thought the task was impossible; they felt the chimps would never become habituated enough to allow a human observer to stand for hours and record their behavior. Ghiglieri's book, East of the Mountains of the Moon (The Free Press, 1988, $22.50), proves them wrong.

Ghiglieri focuses on aspects of chimpanzee violence as a framework for his study, and his book is an important addition to the understanding of chimps, our closest living relatives. But the real charm of this book is Ghiglieri's ability to place the reader in the midst of the hardships of field work, including attacks of malaria, insect roommates, bad food, and trouble with poachers, and then contrast all that with an almost spiritual feeling for what it's like to spend one's whole day watching chimps. As he says, "Chimpanzees are so manlike and their intelligence so superior to that of other mammals that the initial encounter is much like an eerie glimpse through the time-misted veils of our own evolutionary past."

This book is also a personal odyssey. Like any good naturalist, Ghiglieri often sees similarities and connections between the behavior of his subjects and events in his own life.

For those interested in reading about animals in their natural setting, chimpanzees in particular, or just plain high adventure, East of the Mountains of the Moon shouldn't be missed.

Current studies of chimpanzees, of course, owe their conception and gestation to one woman, Jane Goodall. Dr. Goodall pioneered chimpanzee research at the Gombe Stream Preserve, Tanzania, more than 27 years ago, and her studies have revolutionized the way we think about chimpanzees themselves and about the evolution of human behavior. Most of the public is aware of her work from numerous National Geographic specials or from her popular book, In the Shadow of Man (recently re-released). Her newest book, The Chimpanzees of Gombe (Harvard University Press, 1986, $30), provides an in-depth look at the lifework of Dr. Goodall, the scientist.

This volume is the most complete guide to the behavior of the common chimpanzee yet published. Goodall reviews not only the work at Gombe, but also other chimp studies.

Scholars from the People's Republic of China worked at the Institute and the University of California, Berkeley, for five weeks this spring as part of a reciprocal exchange. Shown here examining Olduvai Gorge specimen OH 62: standing, Dennis Ettler, graduate student in anthropology at UC; seated, from left, Professor Li Kunsheng, associate director of the Yunnan Provincial Museum; Professor Zhang Xingye, director of the museum's Paleoanthropology Office; and Dr. William H. Kimbel, assistant director of the Institute. In December and January, a group from the Institute and UC visited China briefly to examine fossils and tour paleoanthropological sites in Yunnan Province. They included Dr. Kimbel; UC Professors Desmond Clark, Clark Howell and Tim White; Ettler and fellow UC graduate student Gen Suwa. An Institute group is scheduled to visit China again this coming winter. The ultimate goal of the exchange program is to establish strong cooperative ties between scientists in the two nations.

The 'African Eve' Hypothesis

While anthropologists are finding clues to our origins in the field, biochemists are writing other exciting chapters in the story of human evolution in their laboratories. One of the most intriguing is the "African Eve" hypothesis, which has received much attention in the press over the past year or so.

As part of IHO's Spring Lecture Series, Dr. Mark Stoneking gave Institute members and friends an inside look at the research which led to this hypothesis and the conclusions that scientists have drawn from that work.

In brief, the hypothesis says that all the varied mitochondrial DNA types in modern humans trace back to a single female who lived in Africa about 200,000 years ago.

Stoneking, a post-doctoral research associate in the Department of Biochemistry at the University of California, Berkeley, did much of the research leading to this conclusion, along with Dr. Allan Wilson and Dr. Rebecca Cann.

Just what is mitochondrial DNA, and how can it tell us about our origins? DNA is the genetic material contained in human cells, mainly in the nucleus. But small amounts of DNA are also found in the mitochondria, organelles in the cytoplasm of the cell, outside the nucleus. And this DNA has some special properties which make it useful to biochemists.

In the first place, mitochondrial DNA is inherited from the mother only, not from both parents. That's because sperm carry all their mitochondria in their tails; the mitochondrial DNA either doesn't enter the fertilized egg or is preferentially destroyed.

This makes it easy to trace inheritance. For example, if you're studying a particular gene found in an individual's nuclear DNA, and go back five generations, you find 32 ancestors who could have contributed that gene. With mitochondrial DNA, only one ancestor could have supplied that gene: the individual's
Continued from page 5

two male forms are as striking as those in appearance, Rodman said.

"Adult" males are highly aggressive toward one another, although they may tolerance a nearby subadult if no female is in the vicinity. If a female is in estrus, adult males will fight for access to her; the winner is accepted by the female and remains in consort with her around the period of ovulation.

The "subadult" male, although very sexually active, has an entirely different approach—one that Rodman termed the "sneak rape" strategy. He will forcibly copulate with a nearby female, as often when she is not in estrus, but sometimes even when she is ovulating and in consort with an adult male. In general, he will try to copulate as often as possible, whether conception is likely at that time or not.

For many years, Rodman noted, scientists believed that "subadulthood" was merely a precursor to full maturity. Since researchers have observed that some males remain "sub-adults" long after their contemporaries attain adult form, their ideas are changing.

Although "subadults" are at a disadvantage in direct competition with adult males, they also reap some benefits from their form. Their smaller size means less energy expenditure; adult males are less aggressive toward them than toward other adults.

It's possible, Rodman concluded, that the two male reproductive strategies exist in a stable relationship to one another, with "sub-adulthood" a viable and long-term alternative to full maturity for some males.

Dr. Donald C. Johanson and Mr. Jonathon Wutawunasha, Charge d'Affaires of the Zimbabwean Embassy, at the April exhibition and sale of Shona sculpture in Pasadena. The sale benefitted the Shona tribe of Zimbabwe, the Pacific Asia Museum, and the Institute.

At the Institute

New faces at the Institute:

David Symonik joined IHO in January as business manager.

Dr. Herbert Ullrich of the Akademie der Wissenschaften (Academy of Sciences) of the German Democratic Republic, Central Institute of Ancient History and Archaeology, has been named to a three-year term as a Scientific Associate of the Institute.

New volunteers include Linda Gearlds, assisting in administration; Kevin Walli, working mainly in the Media Center; and Frank Zima, helping with the new computer system. Volunteers in the casting lab are Will Classen Jr., Reina Milligan, Carol Moeglein, Janet Oyen, Miranda Smith, and Chris Wall.

MEMBERSHIP APPLICATION

PRIVILEGES OF IHO MEMBERSHIP
All CONTRIBUTORS receive the Newsletter and special announcements of Institute activities.

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'African Eve'

Continued from page 6

mother, who got it from her mother, and so on, back as many generations as you'd like.
Mitochondrial DNA also evolves five to ten times more rapidly than nuclear DNA, so it will accumulate many more changes during the same period of time; the more changes, the easier differences between DNA samples are to measure.

To begin with, Stoneking and his associates studied mitochondrial DNA extracted from placental tissue from 241 individuals, a process that began with putting the tissue through a blender "until it looked like a strawberry daiquiri" and ended with highly purified DNA. The scientists then used restriction enzymes to break the DNA into fragments, and electrophoresis to separate fragments by size. At this point they could compare the patterns in one individual's mitochondrial DNA to another's.

They literally counted the differences—and because mitochondrial DNA comes from only one parent, they knew the differences had to be caused by mutation, not recombination.

The researchers found 182 different patterns of mitochondrial DNA, some more closely related than others, and constructed a phylogenetic tree to show the relationships among them. What emerged was a "tree" stemming from a single common ancestor and rather soon splitting into two branches. One "branch" included mitochondrial DNA samples only from individuals of African ancestry; the other, from individuals of African, Asian, Australian, Caucasian and Papua/New Guinea ancestry.

The simplest explanation for this pattern, Stoneking said, is that the common ancestor—the "Eve"—lived in Africa.

Now the biochemists turned to the question of when she lived. Scientists already had a good idea of how fast mitochondrial DNA mutates, from comparing the DNA of different species whose point of divergence was known from fossil evidence. Stoneking and his associates applied this rate to the differences among their samples. They also worked out a timetable based on DNA relationships and the probable dates for colonization of Australia, America and New Guinea.

Applying these methods, they determined that the common female ancestor lived between 140,000 and 280,000 years ago; 200,000 years is a convenient estimate, not an exact date.