PNAS PROFILE

Profile of Susan C. Alberts

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From the moment evolutionary biologist Susan C. Alberts learned, as a sophomore in college, about the beauty of evolution and ecology, she embarked on a lifelong journey of scientific discovery. Before starting graduate school, Alberts got her first taste of field research studying the baboons of Amboseli National Park in Kenya, a population she has since methodically followed for more than 38 years. As codirector of the Amboseli Baboon Research Project (ABRP), Alberts has access to 50 years' worth of uninterrupted data on the baboons' behavior, mating patterns, and health. Her research has revealed that social and physical environments in early life and adulthood interact to affect the baboons' survival and reproduction. For Alberts, the Robert F. Durden Distinguished Professor of Biology and Evolutionary Anthropology and Chair of the Department of Evolutionary Anthropology at Duke University, long-term datasets are unmatched in their ability to answer the scientific questions she has posed throughout her career. Elected to the National Academy of Sciences in 2019, Alberts and her colleagues pooled data from seven long-term primate research projects to examine patterns of reproductive aging among primates for her Inaugural Article (1). The work is the result of the Primate Life History Database (PLHD), a collaboration she helped forge with University of Wisconsin–Madison anthropologist Karen Strier and other researchers working on primates.

Figs: Gateway to Biology

Alberts grew up in Seattle, Washington, when it was a sleepy but beautiful city. Her mother was a homemaker and her father was an economics professor at the University of Washington. With no science role models and as one of the first women in her family to attend college, Alberts started as a philosophy major at the University of Chicago. She quickly transferred to Reed College in Portland, Oregon, where, to fulfill a science requirement, she enrolled in an introductory biology course with plant evolutionary biologist Bert Brehm.

"I remember sitting through the first semester with my mouth open," recalls Alberts, a sophomore at the time. "No one had ever told me about ecology or evolution, and I thought it was the most amazing thing. The day my professor told the class about the exquisite coevolution of figs and fig wasps, I realized I had to become a biologist."

Her last 2 years at Reed College were a crash course in how to be a scientist, a time when she was mentored by evolutionary biologist Steve Stearns. "I was very lucky to have been at Reed in the short period of time that he was there," says Alberts. "He changed my life, not with the kind of flash that Bert Brehm gave me but with a very sustained training over the course of a couple of years in evolutionary and ecological thinking. He was an intellectual mentor who encouraged me to go to graduate school."

Susan C. Alberts. Image credit: Amanda Ward (photographer).

Baboons for Life

Alberts' foray into fieldwork began at the end of her senior year, in 1983, when she received a Thomas J. Watson Foundation fellowship for a year of travel and research. She wrote to several scientists who had field sites and received many discouraging replies until evolutionary biologist Jeanne Altmann, then at the University of Chicago, responded with an offer. Altmann helped create and develop the ABRP in 1971 and offered Alberts the opportunity to go to Kenya and join the data-collection team. "I never looked back," says Alberts. "I went to Amboseli for the year. It was solitary and it was hard, but I just couldn't stop thinking about it when I went back to the [United States]."

Alberts began graduate school at the University of California, Los Angeles, but the lure of Amboseli was irresistible. After finishing her Master's degree, she joined Altmann in Chicago to continue working on the ABRP. For her doctoral thesis she studied how behavioral strategies change over the life course of male baboons (2). As a continuous, long-term research project, the ABRP allows

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Alberts to ask the kind of behavioral questions that intrigue her.

"I'm interested in how behavior connects to life history, and by that I mean the pacing of major events, like birth, maturation, reproduction, death, and how behavior interfaces with life-history pacing and life-history events and responds," she says. The Amboseli baboons, she adds, are suitable models. "They have very highly differentiated social relationships that extend beyond the mother–infant bond. They service and maintain those bonds through social relationship and use them to help solve the problems the world presents to them."

Moving up the Ladder

After completing her doctorate, Alberts received an NIH fellowship to stay at the University of Chicago for a year. She then became a junior fellow at Harvard University for 3 years and a Bunting fellow at Radcliffe College for 1 year. She had her first child, a daughter, in 1998, when Duke University advertised a position in its biology department. For Alberts, the position was a dream job at a school with what she considered one of the strongest organismal biology programs in the country. "I didn't think I would get it because I'm a primate person, but I did, and it has been a fabulous place. They have nurtured my research in really important ways."

Although baboons are Alberts' first love, she also studied elephants for a decade after joining Duke, collaborating with elephant researchers in Amboseli. They conducted the first paternity analysis in African elephants, finding that, unlike most mammals, male African elephants sire more offspring as they get older (3), and uncovering the genetic underpinnings of social group formation (4).

Meanwhile, Alberts continued to spend weeks at Amboseli several times a year, toting along during summers both her first-born and her second daughter, whom she adopted in Kenya in 2004. By then she was codirecting the project, and in 2010 two other codirectors came aboard: Alberts' former graduate students Beth Archie, now at the University of Notre Dame, in Indiana, and Jenny Tung, at Duke. Now that Altmann is retired, the three laboratories divide the work, with the Alberts laboratory specializing in behavioral analyses as well as analyses of hormones found in fecal samples.

The Long Game

Over the years, Alberts' research findings have been a combination of plodding discoveries and Eureka! moments, she says. One of the first breakthroughs with the baboons came after her laboratory mastered a technique to assign paternity through fecal samples (5). Previously, it was difficult to discern which male fathered which infant because fertile female baboons mate with more than one male. Alberts' collaborator John Silk at Arizona State University, asked whether adult male baboons, which intervene to help juveniles engaged in fights, preferentially help their own offspring. No one expected male baboons to identify their own offspring, but the males disproportionately intervened on behalf of the baboons they had sired (6).

Another "aha!" moment came during studies of infanticide. Researchers studying primate populations elsewhere regularly saw males killing unrelated infants, but the ABRP had not observed this trend in Amboseli. "Researchers asked me to publish data on infanticide in Amboseli, so I was motivated to nail it down. I thought we'd get a negative answer," she recalls. With no visible evidence of the behavior, she asked graduate student Matthew Zipple to take a demographic approach. The team compared infant mortality rates and fetal loss rates in the 2 weeks after an aggressive new male moved into a social group with the 2 weeks before the male moved in. To their surprise they found peaks of both infant mortality and miscarriages after aggressive males moved in (7, 8). Further research showed that the behavior is contingent on demographic contexts (8).

Some of Alberts' findings in baboons mirror work in humans, and she believes her work has relevance to questions about human health and wellbeing. "Baboons offer a simplified version of human societies with an accelerated life history, allowing us to watch events play out over the course of a lifespan and connect events in real time that happen in early life to events that play out 20 or 30 years later. We absolutely believe that our data can help us understand what's going on in humans and identify where we can target interventions," she says.

In 2016, Alberts published a study with Tung, Archie, and Altmann, showing that baboons that experience more adversity in early life live shorter lives (9). Other ABRP studies showed that social environment is influential: Animals that are more socially connected live longer (10, 11). Her newest work takes on a debate about whether the adult social environment and the early-life environment act independently to affect adult survival or whether the two environments interact. "It looks like they're pretty independent," she says. The finding carries potential implications for humans, suggesting that health and social interventions may be effective in both early life and adulthood.

Alberts says she owes her discoveries to long-term investment in longitudinal research (12). To further leverage the investment, in 2006 Alberts and colleagues formed the PLHD to compare findings from multiple longitudinal primate research projects that had each amassed at least 20 years' worth of continuous data. Along with the ABRP, the projects include studies on eastern chimpanzees, mountain gorillas, white-faced capuchins, and blue monkeys. For her Inaugural Article (1), Alberts and colleagues used the PLHD data to examine whether there are general patterns of reproductive aging among primates. The article poses three main questions: Does a female primate's age affect reproductive rate? Does maternal age affect offspring survival? And does maternal age affect the age at which female offspring reach maturity? An earlier analysis showed that menopause is unique to humans (13). "We were really interested in following that up and looking at other aspects of reproductive aging to identify where ecology plays a role and where there are primate-wide patterns," says Alberts.

Data from six of the seven species showed that age had an effect on reproductive rate, with longer interbirth

intervals in the oldest mothers, the youngest mothers, or both. Five species showed much lower survival among offspring born to the oldest mothers, and two species showed lower survival among offspring born to both the youngest and oldest mothers. "We found both contrasts and shared patterns of age-related changes in female fertility," says Alberts. "And the differences seem to be related to species-specific behaviors and life-history patterns."

Alberts looks forward to her sabbatical in 2022. She says she cannot wait to spend much of it where her heart has remained since graduating from college: in Amboseli with the baboons.

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