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Molecular anthropologist Connie Mulligan uses genetic samples to track the movements of ancient populations.
How did I get into this situation I thought as I took a blood sample from a bright-eyed young man holding an automatic rifle.

Here I was — a blond, female anthropologist who could hardly say hello in Arabic, 7,700 miles from home on a roadside in the staunchly patriarchal Middle Eastern country of Yemen.

Even more surprisingly, the weapon did not bother me. It’s amazing how quickly you get used to armed men walking about. Besides, even though many of the men carried guns, they were friendly and joking as they milled about, waiting for me and my postdoctoral associate, Ryan Raaum, to take blood and saliva samples from them.

Undoubtedly, their friendliness grew out of the fact that we all wanted to answer one of those universal questions that bridge languages and cultures: How did we get here — here in the world, here in history, here as a species?

Here was Yemen, or Al Yaman as it is called by the local people, who were as interested as I was in finding out whether their country was the gateway for early humans in their journey out of Africa.

As recently as 10 years ago, anthropologists believed the first anatomically modern humans moved northward from east Africa across the Sinai Peninsula and from there into Asia and Europe.
But evidence is gathering that the route may have been more southerly. Located at the bottom of the Arabian Peninsula with just a sliver of the Red Sea separating it from Africa, Yemen could be ground zero — the first place migrating people would have set foot as they left the Horn of Africa.

For the people who live in this hot, rugged land, the matter is of major cultural significance. Yemen is one of the oldest centers of civilization in the world, dating back more than 12,000 years. It makes sense that when humans as a group took their first steps outside of Africa, their path would have taken them here.

I have long been interested in tracking the movement of people to determine how the Earth came to be populated. But I don’t excavate archeological sites, sift through layers of geologic strata, or carbon-date fossils. Population geneticists like me use sensitive genetic tests to look at DNA sequences in modern populations, with the idea that these sequences were forged by an accumulation of events in the distant past.

No shovels or heavy lifting is required. All that’s necessary is to collect spots of blood and saliva from individual volunteers — relatively easy to do in concept, but something altogether more challenging in practice.

**YEMEN CONNECTION**

Based on my earlier research, I wrote a proposal that the National Science Foundation funded for $311,000 to look at the first migration of anatomically modern humans, with a focus on testing the hypothesis of a southern migration route from Africa to southern Arabia to Eurasia.

The immediate obstacle was finding a Middle Eastern country that would allow us to do the work. The first candidate was Oman, which is actually east of Yemen, but far
more affluent and also more moderate in terms of foreign policy, which made it seem politically accessible. Oman even participates in the prestigious Fulbright program, which aims to increase mutual understanding between people from the United States and different countries.

However, even armed with Fulbright support, my plans to visit Oman in the summer of 2005 never materialized, for reasons that remain unclear. My take was that the research may have been considered politically sensitive, and I have been told recently that there is a great distrust of genetic research.

Whatever the case, Oman was out. But if Oman was impossible, what kind of reception could I expect in Yemen, a decidedly less cosmopolitan country that the U.S. State Department designates as a major security threat for travelers?

Enter Leo Villalon, director of the Center for African Studies in UF’s College of Liberal Arts and Sciences. Based on his suggestion, I contacted Christopher Edens, the resident director of the American Institute of Yemeni Studies in Yemen, who was very supportive of my research and helped make everything possible.

And, just like that, I was going to Yemen.

**EVOLUTIONARY EVIDENCE**

With Edens’ help, I was introduced to Ali Al-Meeri, vice dean of student affairs and professor of biochemistry at Sana’a University in Yemen. In the course of just 30 minutes, Al-Meeri told me that not only was he interested in the research, he wanted to accompany me in the field and help collect biological samples.

I couldn’t imagine why someone so high ranking in the university and in the government would want to go on my collecting trip. But it was clear Al-Meeri was making an intellectual commitment, too. He saw our collaboration as a long-term project between my team and Sana’a University, and he believed a genetics project could bring needed technological expertise to his country.

We designed a six-week schedule in April and May where Al-Meeri and Raaum would stay for the duration, while I would be there for two weeks at the beginning and two weeks at the end.

We wanted to get samples from throughout Yemen to represent geographic, ethnic and linguistic diversity, on the assumption that this will give us the complete genetic representation of the people there and capture their full evolutionary history.

When all was said and done, we sampled 550 individuals hailing from most of the regions of the country — enough to provide data that will keep me busy for at least five years. Now comes the lab work.

We’re looking at mitochondrial and nuclear DNA in order to capture the full genetic variation of every individual. In the
same way we geographically sampled the country, we want to completely sample the genetic diversity of the country also.

Mitochondrial DNA is inherited only from mothers and the Y chromosome is inherited only from fathers, while the remaining nuclear DNA (X chromosome and the autosomes) is inherited from both parents. I believe that if we look at genetic markers from all of these genomes and chromosomes, we can extract many clues about our evolutionary history.

Our initial results show that Yemeni populations do indeed share many old mitochondrial, Y and nuclear lineages with African populations as well as many lineages found outside of Africa. This supports the idea of an ancient migration out of African into Yemen.

The next question is, do the non-African lineages have an origin in Yemen or do they represent back-migration to Yemen? Sophisticated simulation analyses suggest that Yemeni populations may have been formed by an ancient migration out of Africa followed by subsequent gene flow from both Africa and Asia, which is completely consistent with our initial proposal of a migration of anatomically modern humans out of Africa along a southern route.

We also have data suggesting that a genetically distinct population common in Europe may have originally evolved in Yemen prior to its expansion throughout Eurasia. We currently have three papers on these results in the works.

During the collection process, it struck me how incredibly hospitable, natural and easygoing the people were. There was nothing they wouldn’t do for us, whether we were working or socializing. When “Dr. Ali,” as we called him, told people about the study, they all wanted to participate, with no suspicion. They really like the idea that the first human global expansion may have occurred through Yemen, and the only time I saw any of the people irritated was when I would run out of collecting supplies and had to turn potential volunteers away.

BEHIND THE VEIL

In all, Dr. Ali guided us through six of the 19 different governates of the country, introducing us to important local leaders, doctors and the townsfolk in general. I’ve never had an easier collection trip.

The women particularly seemed eager to talk to me. At home, they removed the black outer garments called abayas that they wear in public or in front of men they are not related to, and we would have conversations.

When we collected samples in Dhamar, we stayed with Dr. Ali’s relatives and the wife of the house brought every English-speaking Yemeni woman she could find into her house to help bridge the communication gap between her Arabic and my English. We talked religion, culture, family. We talked openly, without rancor, about the United States and the “war on terror.” We talked about their hopes and dreams and career goals.

They wanted to know everything about women in the U.S. They wanted to know what I used as sunscreen, because they were concerned about their skin getting dark. They wanted to know what kind of makeup I wore, even how much I weighed — I actually got on a scale for them.

I’m sure that most people didn’t know what to make of me, a white woman traveling throughout the country without her husband, asking for blood samples. But on my last trip, I had my 10-year-old son Michael with me, and I became something universally identifiable to them: a mother.

Through it all, I was never frightened, although I was often on my own.

This sense of security prevailed despite the fact that the display of firearms is part of Yemen culture, especially in the rural areas. But they seemed to take pains not to use them in front of us, or at least to not involve foreigners in local conflicts.

Actually, I’ve never been in a country where my movements were tracked so carefully, and I believe they did this just to make sure I was safe. There are a lot of checkpoints along the roads, so if our group didn’t make it from one to the next, people would come looking to make sure we were OK.

Ironically, I returned from Yemen the day after the shootings at Virginia Tech. The tragedy was all over the airport monitors, all the newspapers, and I thought, “I’m coming from a country that’s supposed to be dangerous and entering a country that’s supposed to be safe. Could it be that our perceptions about how safe the United States is and how dangerous the rest of the world is are all wrong?”

It is a question I continue to ponder, but right now I’ve got DNA to analyze!

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Humans Lived 20,000 Years In Beringia Before Reaching Americas

The human journey from Asia to the Americas was interrupted by a 20,000-year layover in Beringia, a once-habitable region that today lies submerged under the icy waters of the Bering Strait.

Furthermore, the Americas were colonized by approximately 1,000 to 5,000 people — a substantially higher number than the 100 or fewer individuals of previous estimates.

The developments, reported by University of Florida Genetics Institute scientists in the online journal *PloS ONE*, help shape understanding of how the Americas came to be populated — not through a single expansion event as put forth in most theories, but in three distinct stages separated by thousands of generations.

“Our model makes for a more interesting, complex scenario than the idea that humans diverged from Asians and expanded into the Americas in a single event,” said Connie Mulligan, an associate professor of anthropology and assistant director of the UF Genetics Institute. “If you think about it, these people didn’t know they were going to a new world. They were moving out of Asia and finally reached a land mass that was exposed because of lower sea levels during the last glacial maximum. Two major glaciers blocked their progress, so they basically stayed put for about 20,000 years. It wasn’t paradise, but they survived. When the North American ice sheets started to melt and a passage opened, we think they left Beringia to go to a better place.”

UF scientists analyzed DNA sequences from Native American, New World and Asian populations with the understanding that modern DNA is forged by an accumulation of events in the distant past, and merged their findings with data from existing archaeological, geological and paleoecological studies.

The result is a unified, interdisciplinary theory of the “peopling” of the Americas, which shows a gradual migration and expansion of people from Asia through Siberia and into Beringia starting about 40,000 years ago; a long waiting period in Beringia where the population size remained relatively stable; and finally a rapid expansion into North America through Alaska or Canada about 15,000 years ago.

“This was the raw material, the original genetic source for all of the Americas,” said Michael Miyamoto, a professor and associate chair of zoology in UF’s College of Liberal Arts and Sciences. “You can think of the people as a distinct group blocked by glaciers to the east. They had already been west, and had no reason to go back. They had entered this waiting stage and for 20,000 years, generations were passing and genetic differences were accumulating. By looking at the kinds and frequencies of these mutations in modern populations, we can get an idea of when the mutations arose and how many people were around to carry them.”

Working with mitochondrial DNA — passed exclusively from mothers to their children — and nuclear DNA, which contains genes from both parents, UF scientists essentially added genetic information to what had been known about the archaeology, changes in climate and sea level, and geology of Beringia.

The result is a detailed scenario for the timing and scale of the initial migration to the Americas, more comparable to an exhaustive video picture rather than a single snapshot in time.

“Theyir technique of reading population history by using coalescence rates to analyze genetic data is very impressive — innovative anthropology and edge-of-the-seat population study,” said Henry C. Harpending, a distinguished professor and endowed chairman of anthropology at the University of Utah and a member of the National Academy of Sciences who was not involved with the research. “The idea that people were stuck in Beringia for a long time is obvious in retrospect, but it has never been promulgated. But people were in that neighborhood before the last glacial maximum and didn’t get into North America until after it. It’s very plausible that a bunch of them were stuck there for thousands of years.”

As for Beringia, sea levels rose about 10,000 to 11,000 years ago, submerging the land and creating the Bering Strait, which now separates North America from Siberia with more than 50 miles of open, frigid water.

“Our theory predicts much of the archeological evidence is underwater,” said Andrew Kitchen, a Ph.D. candidate in the anthropology department at UF who was lead author in the research. “That may explain why scientists hadn’t really considered a long-term occupation of Beringia.”

John Pastor