'New' Science Gleans Knowledge From Ancient Lands And Societies

November 9 2005

Understanding how pollution effects the dynamics of Earth and the spread of disease in ancient times are two areas in which ASU's new School of Human Evolution & Social Change can make a dramatic and immediate impact, said Sander van der Leeuw, director of the school.

By drawing from a wide range of expertise and considering several perspectives outside the traditional anthropology disciplines, researchers at the school will be well equipped to take on important problems of today by understanding what they looked like in the past.

Diagnosing a healthy Earth

In the wake of hurricanes Katrina, Rita and Wilma major news organizations are asking if human caused global warming is intensifying the power of deadly storms. For example, a recent cover story of Time asks: "Are we making hurricanes worse?"

Van der Leeuw said that while we begin to know a little about the long-term history of Earth's climate due to the research being done on polar ice-cores, we know hardly anything about the impact of climate changes of human life on Earth and even less about the human impact on the environment.

In the Southwestern U.S., analysis of tree growth rings has demonstrated that the current climatic conditions of temperature and precipitation

have not occurred at any time in the past 2,000 years.

Such long-term research can help to understand the natural fluctuations in Earth's average temperature or even the fluctuations in the density of atmospheric gases on Earth, but it tells us little about hurricane strength over periods of thousands of years and even less about questions concerning human activities such as how large-scale deforestation, for example, have changed the regional, or even the world climate.

"Modern climate and environmental research is based on 150 to 200 years worth of instrumental data, but humans have been on Earth for hundreds of thousands of years," van der Leeuw said.

"We must try to find other techniques to begin to understand what happened in the more distant past. Once we can determine how far we are beyond that natural range of temperatures and the natural range of gases in the atmosphere, then we can begin to think about how to bring the 'Earth system' back to a more sustainable state."

Thus, through studying what happened in ancient times, van der Leeuw added, "we can get a clearer picture of what Earth was like when it was more pristine, more healthy, rather than diagnosing it based only on evidence after the planet has become 'sick' with pollution."

The rise, fall and rise of tuberculosis

For Jane Buikstra, knowing more about what happened in ancient times can help humans deal with the present and plan for the future. Tuberculosis, one of nature's most enduring and adaptable infectious diseases, is an example.

Tuberculosis (TB) has plagued humans and animals for thousands, perhaps millions, of years. Though in decline during the first half of the

20th century, TB has reawakened in both developed and developing countries, especially among groups whose health is already compromised.

Buikstra, director of ASU's new Center for Bioarcheological Research within the School of Human Evolution & Social Change, has studied the history of this persistent disease, examining evidence for TB in ancient human groups from throughout the Americas and Europe.

She has written extensively on the topic, including a recent co-authored volume, "The Bioarcheaology of Tuberculosis: A Global View of a Reemerging Disease," which explores archaeological, historical and contemporary expressions of the disease.

Tuberculosis epidemics have surged through human groups across the globe at many points in history. It then virtually disappears, only to reappear decades or even centuries later. Some cycles are limited to pulmonary expressions and in others the pathogens spread throughout the body and cause severe bone deformities.

"To account for past cycles and to predict the form taken by future ones, we must bring studies of the deep past into today's world," Buikstra says.

"Our research group is currently collaborating with biomedical scientists to examine the timing of TB's origin in the ancient Americas, as well as the separate evolutionary trajectories followed by strains and subspecies drawn from across the globe. If our hypotheses are correct, TB followed a different pattern here in the 'New World,' -- one that was less virulent. We want to learn why."

To address this issue, the researchers use model genetic histories for the TB pathogen that are based in modern molecular genetics. They test them through the investigation of ancient DNA, recovered from

archaeological remains.

"Comparison of the introduced 'Old World' organisms that we hypothesize replaced and extinguished the less virulent American strains, may shed light on determinants of virulence today, especially important in situations where antibiotic therapy is either not available or ineffective," Buikstra says.

In a further extension of the TB studies in the Americas, the researchers are collaborating with medical anthropologists, indigenous peoples and health care institutes in South America to understand the factors that contribute to human differences in susceptibility to TB. So far, they have found these factors include host genetics, cultural practices, diet, the effects of poverty and crowding, and encounters with other pathogenic organisms, according to Buikstra.