Department of Anthropology
COLLEGE OF ARTS & SCIENCES

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

APPLICATION DEADLINE: March 1, 2010

The Department of Anthropology is pleased to offer the following research project for the summer of 2010. Interested students are urged to contact the faculty member(s) directing the project that most interests them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be and, if possible, develop a timetable for the twelve-week research period.

PROJECT TITLE: BIOMECHANICS OF HUMAN FEMALE TRAVEL: INFANT CARRYING

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Project Description

The emergence of habitual bipedal walking is evident in the earliest fossil hominins some 7 million years ago soon after the divergence of the chimpanzee and human lineages. It is increasingly clear that the human evolutionary record tracks a series of adaptive radiations, the first of which was a widespread dispersal within Africa following the critical transformation to terrestrial bipedalism. This initial transition from nonbiped ancestor to earliest hominin has long been considered an evolutionary event of marked anatomical reorganization. Several studies focusing on locomotor energetics suggest that walking cost in early bipeds was lower than that of other apes. Given that walking and running cost derive from energy expended to stabilize the body center of mass, displacements of the center of mass hold high potential to compromise locomotor economy. Curiously, although bipedalism poses a unique challenge to females because prenatal and postnatal loads shift the trunk's center of mass away from the hips, experimental data on the dynamic conditions of pregnancy and infant carrying are largely lacking from decades of locomotor study. Given subsequent dispersals beyond Africa and probable hairlessness 2 million years ago, early *Homo* females burdened with prenatal and postnatal loads would have been markedly challenged because dependent infants traveling with bipedally active and hairless mothers were less able to contribute to their own load carrying, placing greater biomechanical demands on adult females.

In this study we investigate the biomechanics of bipedal female travel in the context of

infant carrying using an integrated approach that combines experimental measures of kinematics and kinetics in modern human females with an anatomical model linking locomotor anatomy and gait performance to hominin evolution. The carrying load accelerates as the infant gains mass, and load instability increases as the infant with fewer positional constraints assumes postures and orientations relative to its mother that are precluded in the uterine gestational environment. In this manner, the infant becomes a less predictable and more massive load, extending the biomechanical challenge of female reproductive success well beyond the duration of pregnancy. Furthermore, because human mothers are hairless and human infants lack a grasping foot, the load carry is assumed to be entirely maternal in derivation. How mothers meet the biomechanical challenge and locomotor cost is uncertain. Twenty-five healthy female adults and their healthy infant offspring will be studied in the UC Human Evolutionary Locomotor Lab where a motion analysis system will record 3D positional data from each maternal/infant pair during quiet stance and while walking naturally. Kinematic and force-plate data will be captured to calculate the maternal/infant total body center of mass. Students joining this project will be fully integrated into the laboratory research program through active data collection and data analysis.