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Measuring bacterial communities in the humerus to estimate PMI

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Methods of estimating postmortem interval (PMI), or time since death, are largely dependent on changes in soft tissues, and the sampling of insects and bacteria. These traditional methods are influenced by several biotic and abiotic factors, such as moisture, temperature and geography. The interior of marrow-containing bones, however, are largely protected from many of these variables, and also persist much longer in the environment. Our research, therefor, focuses on estimating PMI based on bacterial community composition and succession in marrow-containing bones. We hypothesize bacterial communities inside the human humerus will change in a predictable and consistent manner. We began sampling three cadavers (two males and one female) at Southeast Texas Applied Forensic Science (STAFS) facility in Huntsville, Texas, in May, 2016. Over four months, the left humerus was sampled every two days and the right humerus every eight days as a control for contamination. We used sterilized T-Lok bone marrow biopsy needles and a sterilized drill to extract marrow samples, and froze samples for shipment to Baylor School of Medicine. Microbiota were measured by deep sequencing of the 16S rRNA gene specific to bacteria, and statistical analysis of bacterial communities were determined using UniFrac. Preliminary results suggest that bacterial communities inside the humerus change at a predictable rate and are largely consistent across specimens. The results of this research could provide for improved methods of estimating PMI, which will be a valuable tool for forensic scientists and law enforcement.

Seed Dispersal Effectiveness in Two Populations of Bornean Orangutans (*Pongo pygmaeus wurmbii*)

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Orangutans consume large quantities of ripe fruit and disperse intact seeds over wide areas. However, few studies have quantified seed dispersal in orangutans (Galdikas 1982; Nielsen *et al.* 2012). We hypothesized that orangutans are effective seed dispersers. This was tested by identifying, measuring and counting seeds in orangutan feces and recording fecal coordinates to determine seed spatial distribution patterns. Orangutan feces were collected opportunistically from March- September 2015 at the Tuanan Research Station (*n*=97) and from July- August 2016 at the Cabang Panti Research Station in Gunung Palung National Park, Indonesia (*n*=98). The feces were sieved, seeds were counted, and seed morphotypes were identified in at least 96% of fecal samples. Flanged males, unflanged males, adult females, and juveniles independent enough from their mother to allow for fecal collection, were all observed dispersing seeds. Four fruit genera were dispersed at Cabang Panti and nine fruit genera were dispersed at Tuanan. At Cabang Panti, the largest intact seed size recorded was 2.29cm in length and the smallest seeds dispersed were less than 1mm *Ficus* seeds. At Tuanan, 31% of fecal samples had 2 or more genera, 42% had 1 genera, and 26% had no seeds. We used descriptive GIS to describe the spatial distribution of the dispersed seeds. We concluded that orangutans have an important role in fruit tree recruitment. They disperse intact seeds of varying sizes and disperse several different genera of seeds. Future research will measure seed dispersal distances and orangutan gut-passage rates to establish the orangutan seed shadow.

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Immune function across the life-span in Amazonian horticulturalists

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Amazonian populations are exposed to diverse parasites and pathogens, including protozoal, bacterial, fungal, and helminthic infections. Yet much of our understanding of the immune system is based on industrialized populations where these infections are relatively rare. We examine distributions and age-related differences in 22 measures of immune function for Bolivian forager-horticulturalists and US and European populations. Subjects were 6,338 Tsimane aged 0-90 years. Blood samples collected between 2004-2014 were analyzed for 5-part blood differentials, C-reactive protein, erythrocyte sedimentation rate (ESR), and total immunoglobulins E, G, A, and M. Flow cytometry was used to quantify naive and non-naïve CD4 and CD8 T cells, natural killer cells, and B cells. Compared to reference populations, Tsimane have elevated levels of most immunological parameters, particularly immunoglobulins, eosinophils, ESR, B cells, and natural killer cells. However, monocytes and basophils are reduced and naïve CD4 cells depleted in older age groups. Tsimane ecology leads to lymphocyte repertoires and immunoglobulin profiles that differ from those observed in industrialized populations. These differences have consequences for disease susceptibility and co-vary with patterns of other life history traits, such as growth and reproduction. Moreover, an understanding of immune function under high pathogen stress may help us to understand the emergence of many non-infectious diseases in industrialized populations where pathogen stress is low.

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Tooth size, trait expression, and nutritional stress

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Physiological disruption, e.g. nutritional stress, often results in a slowing of growth and development in human biological systems. We investigated the relationship between nutritional stress and dental characteristics (crown size and trait expression) in maxillary dental casts of adolescents from Tezonteopan, Mexico. The unique casts are from individuals (n=34) who were provided daily nutritional supplements early in development and others (n=39) who were not (Chavez and Martinez, INN, Mexico City, 1979). We recorded buccolingual and mesiodistal diameters, and trait expression following ASUDAS. Based on previous research on nutritionally stressed samples, we predicted that teeth of the non-supplemented group would exhibit more variable trait expression and smaller size than teeth of the supplemented group. As predicted, we found the supplemented group exhibited significantly larger lateral incisors and canines than the non-supplemented group. However, no significant differences in crown size were found for other tooth types. Unexpectedly, the supplemented group exhibited significantly higher degrees of expression for double-shovel and tuberculum dentale. Conversely, as predicted,