## G56 The Composition and Succession of Soil Microbial Communities Following Cadaver (*Rattus rattus* L.) Burial

*David O. Carter, PhD*, Department of Plant Pathology, University of Nebraska-Lincoln, 406 Plant Sciences Hall, Lincoln, NE 68583-0722; David Yellowlees, PhD, School of Pharmacy and Molecular Sciences, James Cook University, Douglas, QLD 4811, Australia; and Mark Tibbett, PhD, School of Earth and Geographical Sciences, University of Western Australia, Crawley, WA 6009, Australia*

After attending this presentation, attendees will understand fundamental principles concerning the composition and population dynamics of soil microbial communities associated with cadaver decomposition in soil.

This presentation will impact the forensic community and/or humanity by demonstrating the potential for microbial succession as a basis for estimating postmortem interval.

Recent research has shown that the soil microbial biomass can respond positively to the burial of a juvenile rat (*Rattus rattus*) cadaver. However, it is unknown what components (bacteria, fungi) of the soil microbial biomass are associated with this increase in microbial abundance. It is well understood that the amendment of soil with an organic resource (such as a cadaver) can result in a shift in the composition of the soil microbial community. Furthermore, the composition of microbial communities can also change as a resource decomposes and these successional changes may provide a basis to estimate postmortem interval.

The current experiment aims to demonstrate the concentration and succession of Gram-positive bacteria, Gram-negative bacteria, and fungi associated with cadaver breakdown. In order to investigate this, a field experiment was conducted at two disparate field sites during the dry season (March 2003). Site 1 comprised a loamy sand soil (84% sand, 11.1% silt, 4.9% clay) and was located in Yabulu, Queensland, Australia. Site 1 receives an average rainfall of 140 mm during the dry season (MarchOctober) and average maximum/minimum temperature equals 22.9 C/16.7 C. Site 2 comprised a sand soil (97.7% sand, 1.3% silt, 1% clay) and was located in Pallarenda, Queensland, Australia. On average, site 2 receives 120 mm of rainfall during the dry season and the average maximum/minimum temperature is 26.9 C/16.4 °C. The resulting vegetation at the two sites was dominated by grasses with scattered trees. These characteristics are typical of a tropical savanna ecosystem.

Juvenile rat (*Rattus rattus*: ~18 g) cadavers were buried (2.5 cm) in the center of a 2 $m^2$ plot. Cadaver mass loss and phospholipid fatty acid (PLFA) concentration of soil directly surrounding each cadaver were measured at 7, 14, and 28 days following burial. To measure PLFA concentration soil was amended with a chloroform:methanol:phosphate buffer, shaken and centrifuged. Supernatant was removed, placed in a clean glass culture tube, and dried under nitrogen ($N_2$). Dried lipids were resuspended in chloroform and phospholipids were eluted with methanol through a silicic acid column and dried under $N_2$. Dried phospholipids were amended with acidified methanol, incubated for 12 hours at 60 °C, and amended with purified water and petroleum ether. The ether layer was transferred to a clean culture tube and dried under $N_2$. Standard (19:0) and hexane were added to the dried ether layer and PLFAs were separated by capillary gas chromatography using an automated procedure developed by MIDI (MIDI, Inc. Newark, DE). PLFAs were used as markers of Grampositive bacteria (15:0, i15:0, i16:0, 17:0, i17:0, a17:0), Gram-negative bacteria (cy17:0, cy19:0, 16:17c, 16:17t) and fungi (18:26c). This experiment was replicated four times and controls (soil without cadaver) were used.

After one week's burial cadaver decomposition at Site 2 (1/3 mass loss) was greater than at Site 1 (1/4 mass loss). All cadavers lost approximately ¾ of mass after two weeks at which time the larger soil microbial community was found at Site 1. At this site, the microbial community was dominated by bacteria throughout, and Gram-positive and Gram-negative bacteria comprised equal fractions of the population. Fungal PLFA's were detected after two and four weeks only. The microbial community at Site 2 was also dominated by bacteria for the first two weeks after burial, and Gram-positive and Gram-negative bacteria also comprised equal fractions of the bacterial population. In contrast to site 1 however, the microbial community was dominated by fungi on day 28.

These findings are not surprising considering the introduction of a high-quality; complex resource (such as a juvenile rat cadaver) tends to result in the proliferation of bacteria. As these resources are depleted bacteria are commonly replaced by fungi, which are more tolerant to moisture stress and can be indicators of low soil nutrient status. The difference in succession between soils may be because cadavers buried at Site 2 reached skeletonization prior to cadavers buried at Site 2. These successional sequences may be used as a basis to estimate postmortem interval of cadavers that have progressed into the skeletonization stage of decomposition. The dynamics of specific PLFAs will be presented in relation to cadaver decomposition stage.

**Taphonomy, Succession, Phospholipid Fatty Acid Analysis**

 ** Presenting Author*