Non-invasive measurements of metabolic rates in wild animals

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Measuring metabolic rates in wild animals helps us understand how animals use energy under normal conditions, and how energy use changes when they are under stress. Metabolic rates are normally measured in wild animals by either surgically implanting heart rate monitors or injecting the animals with a harmless isotopic tracer that is eliminated from the body over time through metabolic and other natural processes. Both of these techniques, which are routine and widespread in the natural sciences, involve capturing the animal, handling it, and doing something fairly invasive to it – either taking blood samples or doing surgery. Non-invasive techniques reduce the need to remove the animal from its natural environment and subject it to stressful procedures. We tested a non-invasive technique using a tracer – isotopically labeled water – which is metabolically equivalent to body water and yet distinct and easily measured.

Weighing babblers – Yitzchak Ben Mocha

We worked with Southern Pied Babblers, a cooperatively-breeding bird endemic to the Kalahari in southern Africa. Southern

Preening Babblers – Nicholas Pattinson

Pied Babblers are territorial, primarily forage on the ground, and live in groups of 3 – 15 individuals. In seven captive birds, we confirmed that faeces can be used instead of blood for calculating metabolic rates. We also fed beetle larvae injected with the isotopic tracer to 31 wild and free-living birds and collected their faeces (rather than blood) to track changes in the levels of the tracer in their bodies over time. We were able to measure these birds' metabolic rates in the field and did not need to handle them in order to do so. Our approach, using oral dosing and faecal sampling, proved practically feasible and generated sensible data. For example, we were able to detect a decrease in average metabolic rates on hot days – a relationship that is expected as the birds invest less energy in keeping warm and also reduce activity levels in order to avoid producing unnecessary metabolic heat.