

The pioneers of South America

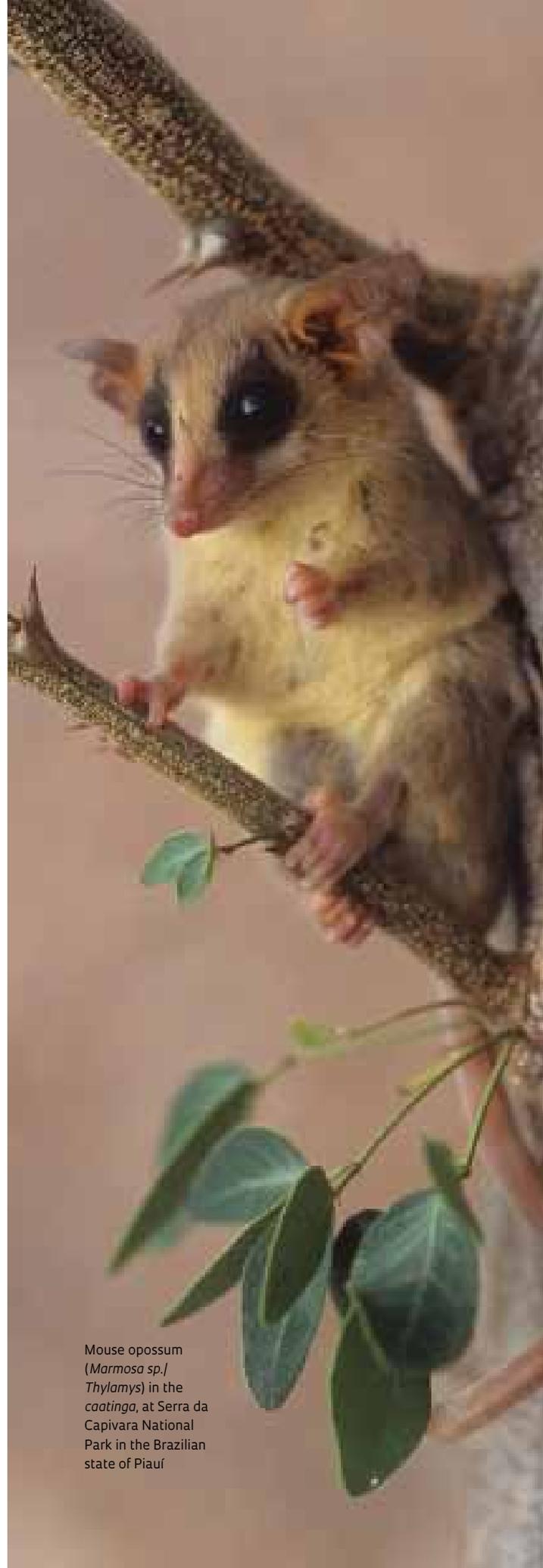
Skunks and other Brazilian marsupials came before Australian kangaroos on the evolutionary scale

Francisco Bicudo

Between bibliographical research, laboratory analyses and field collection, a workday can last twelve hours. It is tiring, but the extra effort is worth it: by the end of 2012, Ariovaldo Cruz Neto, a researcher from the São Paulo State University (Unesp) at Rio Claro, intends to collect valuable information on energy metabolism – basically producing and using energy, in ten species of marsupials that live in South America. On the other side of the planet, Australian researchers who are participating in the project are stepping up the pace and want to contribute with the description of thirty species that live there.

“In the international literature, we have already compiled information for a database with studies on some seventy species, conducted in the last three decades. With this new information, we will have more than one hundred,” notes Cruz Neto. He explains that knowing consumption habits and identifying how the marsupials accumulate and burn energy is essential to understanding the relations they establish with the milieu they live in, how they adapt to different climate conditions, how they respond to the availability of natural resources, how they share their niches with similar species, as well as their reproductive habits. Using this data, it becomes possible to simulate how they would behave in difficult and rupture scenarios, such as changes in climate, fragmentation of the habitat or the presence of predators or exotic species.

“Energy metabolism is a highly integrative and representative measure that expresses both the pressure that the environment puts on the animal and the responses that animals develop to survive in that habitat,” the Unesp researcher ex-



Mouse opossum (*Marmosa sp./Thylamys*) in the caatinga, at Serra da Capivara National Park in the Brazilian state of Piauí

plains. “In addition, by observing and comparing the functioning of metabolism, we can help to better understand the evolutionary history of the species and to identify kinship relations,” he adds. Although still in the preliminary stage, the studies conducted by the group he coordinates suggest that South American marsupials are the pioneers on the evolutionary scale, and that the Australians came later and are younger relatives of those that live on the American continent.

The scientific story outlined by Cruz Neto’s team, always in partnership with the Australians, indicates that the marsupials first appeared in South America approximately 160 million years ago. Due to the competition encountered with voracious rodents (rats, squirrels, beavers and even capybaras), they sought refuge in niches called low energy niches, where they developed diets mainly based on small insects, which was sufficient to meet their needs for survival and to sustain the slower metabolism that is characteristic of marsupials. The majority of the almost 90 species in South America weigh between ten grams and one kilo and generally lives in forests. The best known are the skunk, the opossum, and the mouse opossum.

Sixty million years ago, along sections of Antarctica that were used as bridges (the continents were much closer), they began to reach Australia. Since they did not encounter any competitors, they were free to explore other environments, like tunnels, wetter forests and even deserts, diversifying their diets and eating insects, sugars, nectar, fruit and even meat. Australia is currently home to almost 200 species of marsupials. The best known in the kangaroo, which can reach the size of an adult human and weigh up to seventy kilos. However, as Cruz Neto explains, this morphological diversification did not mean there were changes to the energy metabolism. “The physiological standard of low consumption and expenditure was maintained as a hallmark of this species. In this regard, there was no selection pressure,” he emphasizes.

In the journal *Pesquisa FAPESP* no. 179, of January 2011, the Unesp researcher says that after concluding the analyses of the metabolisms of two opossum species from South America (*Gracilinanus agilis* and *Micoureus paraguayanus*),

he found that the former has an average body temperature of 33.5 degrees Celsius; the latter, of 33.3 degrees Celsius. The basal metabolic rate was also evaluated. This index shows the minimum level of energy that the animal needs to keep its vital body functions operating properly. To reach this number, these species burn, respectively, 4.8 kilocalories (kcal) and 5.5 kcal per day. After comparing the numbers found, Cruz Neto confirmed that both body temperature and metabolic rate were very similar to that found in Australian marsupials that have already been studied and described. According to the researcher, it is as if marsupials had a suitcase with clothes that enabled them to live in different environments. “Once a marsupial, always a marsupial, in spite of different evolution,” he declares.

A study conducted by researchers from the German University of Münster and published

by *PLoS Biology* in July 2010 revealed that the small *monito del monte*, or mountain monkey (*Dromiciops gliroides*), which weighs only 25 grams and lives in the woods in Chile and Argentina, is probably the link, or oldest living ancestor of both

groups. This species is found in South America, but is physically more similar to the Australian representatives of the group.

Dispersal among the continents led to exclusive characteristics. The water opossum (*Chironectes minimus*), which measures thirty centimeters in length, has a long tail and black stains scattered over its grey body, is an aquatic species; the little water opossum (*Lutreolina crassicaudata*), which is similar to an otter, is semiaquatic. Both are found only in South America. On the other hand, endemic to Australia are the *Tarsipes rostratus*, popularly known as the honey opossum, since it eats nectar, and the *Sarcophilus harrisii*, the famous and feared Tasmanian devil, which is carnivorous and received this nickname precisely for harassing domesticated herds in the regions where it lives. “No South American marsupial follows these diets,” says Cruz Neto, emphasizing that the data are still preliminary and that even more precise data may appear by the end of the year, when he expects to conclude and publish the studies. ■

Marsupials seek refuge in low energy niches and escape competition with rodents

PROJECTS

Bat and marsupial energy: structural bases and functional meaning of basal metabolic rate - No. 2000/09968-8 (2001-2004)

GRANT MECHANISM

Young Investigator

COORDINATOR

Ariovaldo Pereira da Cruz Neto – Unesp

INVESTMENT

R\$441,455.78

SCIENTIFIC ARTICLES

1. ASTÚA, D. Cranial sexual dimorphism in New World marsupials and a test of Rensch’s rule in Didelphidae. *Journal of Mammalogy*. v. 91, n. 4, p. 1011-24. 2010.
 2. COOPER, C.E.; WITHERS, P.C.; CRUZ-NETO, A.P. Metabolic, ventilatory and hygric physiology of a South American marsupial, the long-furred woolly mouse opossum. *Journal of Mammalogy*. v. 91, p 1-10. 2010.
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G’day, kangaroos
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