CARLOS SANCHEZ

**Reduced food intake has affected people's metabolism in a controlled study.**

facility is home to 4 of the world's 20 or so state-of-the-art metabolic chambers, which are like small, sealed hotel rooms that measure minute-by-minute the amount of oxygen that occupants use and how much carbon dioxide they exhale. This allows researchers to track how the occupants use energy with unprecedented precision, says Anderson. The ratio between the two gases, combined with analysis of nitrogen in occupants' urine, indicates whether the occupant is burning fat, carbohydrate or protein.

The trial participants, aged between 21 and 50, were randomized into two groups: 34 reduced their calorie intake by an average of 15%, and 19 ate as usual. At the end of each of the two years, they all underwent tests related to metabolism and biological markers of ageing. They were also placed in a metabolic chamber for 24 hours.

The scientists found that participants on the diet used energy much more efficiently while sleeping than did the control group. This reduction in their base metabolic rate was greater than would be expected as a result of the test group's weight loss, which averaged nearly 9 kilograms per participant. All the other clinical measurements were in line with reduced metabolic rate, and indicated a decrease in damage due to ageing.

## MODEL METABOLISM

Caloric restriction has been known for decades to extend life in different species. In the 1990s, scientists began to identify the genes and biochemical pathways that are actively involved in longevity in the short-lived worm *Caenorhabditis elegans*, and in the fly *Drosophila melanogaster*. These include pathways relevant to insulin sensitivity and the function of mitochondria — cellular structures that use oxygen to generate energy. Later studies revealed that calorie restrictions alter similar pathways in mice and monkeys. Mice on restricted diets can live up to 65% longer than mice allowed to eat freely, and the ongoing monkey studies hint at longer survival and reduced signs of ageing.

"The Rolls-Royce of a human longevity study would carry on for many decades to see if people do actually live longer," says Pennington physiologist Leanne Redman, the lead author of the latest study. CALERIE ran for two years, and aimed to see whether a calorie-restricted diet in humans induces some of the same metabolic, hormonal and gene-expression adaptations that are thought to be involved in slowing ageing in other species during long-term caloric restriction.

Few people would want, or be able, to restrict their diet as severely as the participants in the study. "But understanding the biology of how restricting calories extends life will allow us to find easier ways to intervene," says Anderson.

Redman would like to repeat the study, combining less-ambitious calorie restriction with a diet containing antioxidant food to reduce damage from oxygen free radicals, or with a drug such as resveratrol, which mimics key aspects of calorie restriction.

Other scientists are starting to test restricting calories for a few days every month. Such intermittent limitations have been found to be as effective as continuous calorie restriction in protecting mice against diseases of ageing such as diabetes and neurodegeneration (V. D. Longo and M. P. Mattson *Cell Metab.* **19,** 181–192; 2014). "I think that's going to be a way to get all the benefits, without the problems of constant dieting," says gerontologist Valter Longo of the University of Southern California in Los Angeles, who is embarking on clinical trials of intermittent calorie restriction in various disorders. ■

EXTRASOLAR PLANETS

# Green light for exoplanet probe

*Europe's ARIEL mission will study planetary atmospheres.*

BY ELIZABETH GIBNEY

The world's first space telescope dedicated to studying the atmospheres of exoplanets is set to launch in 2028, after the European Space Agency (ESA) selected the mission for development on 20 March.

The Atmospheric Remote-sensing Infrared Exoplanet Large-survey (ARIEL) — to be built with a budget of €450 million (US$558 million) — will chart more than 1,000 known planetary systems outside our own. Its mission is to understand the links between a planet's chemistry and its environment, says Giovanna Tinetti, a planetary scientist at University College London and principal investigator for the mission. So far, exoplanet probes have mainly focused on finding new planets and measuring their sizes, masses and orbits. "ARIEL can really give us a full picture of what exoplanets are made of, how they form and how they evolve," says Tinetti.

A spectrograph aboard the observatory will study the light that filters through a planet's atmosphere as it passes across the face of its host star, revealing chemical fingerprints of gases that shroud the body. The mission will also try to refine estimates of a planet's temperature by teasing out how light from its star changes when the body moves behind it, revealing details about a planet's overall radiation. Tinetti says that it will monitor the worlds at snapshots in time, and also measure how the chemistry and atmospheres of planets vary across their surfaces and with the seasons.

Since the first exoplanet discoveries in the 1990s, some 3,700 worlds have been confirmed in 2,800 systems. ARIEL will focus on planets that have an estimated temperature of more than 350 °C — and are thus unlikely to host life as we know it — and a range of masses, in particular those heavier than a few Earth masses. The observations will build a 'standard model' of how a planet's chemistry depends on its star and the conditions of its birth, Tinetti says.

ARIEL is one of several exoplanet missions in the works around the world, but its focus on planetary atmospheres is rare. Other missions are studying planet size, density and mass. Together, this generation of telescopes will allow scientists to test models of planetary formation and composition, says Elizabeth Tasker, an exoplanet researcher at the Japan Aerospace Exploration Agency's Institute of Space and Astronautical Science in Sagamihara. ■



© 2018 Macmillan Publishers Limited, part of Springer Nature. All rights reserved.