Keeping mice in the constant climate chamber

In general, humans and animals are highly adaptable. A healthy body adjusts to changes in environmental conditions and food sources without major problems.

In research projects on the **mouse as a model organism**, the question as to why energy balance in mammals may run out of control, subsequently leading to the development of obesity or underweight, or type 2 diabetes is investigated at the institute for **Molecular Nutritional Medicine Technische Universität München**, Else Kröner-Fresenius Center. The mice are kept under controlled conditions in two **Memmert constant climate chambers** specially adapted for this purpose.

Memmert constant climate chamber of Generation 2012 appliances with LED light module

An imbalance of energy metabolism causes diseases

‘Fat people are lazy, pleasure seeking and without drive.’ The perception of overweight people is in many cases based on prejudices, says behavioural researcher Tanya Berry as she explains the results of a study by the University of Alberta. But it has been long known that, apart from a wrong **diet** and the lack of exercise, hereditary and environmental factors, stress and diseases such as hypothyroidism can trigger excess weight and obesity.

A healthy body is able to adapt to various dietary components and methods of nutrition. Why the energy balance gets out of hand in some people, causing a permanent imbalance between energy intake and energy consumption, is being studied at the **Institute for Molecular Nutritional Medicine** under the direction of Prof. Dr. Martin Klingenspor at the Weihenstephan Center for Life and Food Sciences at the **Technische Universität München**. With a positive energy balance, the result is being **overweight** and, on a long-term basis, **obese**, whereas anorexia and cachexia (pathological emaciation) occur with a negative energy balance. The influence of a high calorie, fat-rich **diet** on energy balance, as well as the influence of the ambient temperature on the development of diet-induced **obesity** is being studied, mostly in the ‘**model organism** mouse’. In particular, research is directed towards the regulation of the daily energy supply through the diet, energy storage in adipose tissue and the energy consumption for digestion and absorption, basal metabolism, growth, thermoregulation and activity.

The Institute for Molecular Nutritional Medicine is conducting research on the genetic causes of **obesity**.

Influence of the ambient temperature on energy requirements

“The ambient temperature has a crucial influence on the energy requirements for temperature regulation,” explains Professor Dr. Klingenspor, head of the **Institute for Molecular Nutritional Medicine**. “At temperatures below their thermal comfort zone (thermoneutral zone), mammals need to find additional energy for heat production in order to compensate for the increased loss of heat to the surroundings.” For projects in nutrition and metabolism research, it is therefore important to measure the metabolic rate under defined thermal conditions. “The thermoneutral

zone of **mice** lies at +30 to +32 °C, yet the normal room temperature when **keeping mice** is usually about +22 °C. This normal room temperature represents a slight cold stimulus for the mice, resulting in considerable physiological adaptation. With a **mouse** which is moved from a temperature of +30 °C to +22 °C, the pulse increases from 350 - 440 to 550 - 600 beats per minute and the metabolic rate increases 2 to 3 fold," explains biologist Nadine Rink, doctoral candidate at the Institute. "Food intake is increased to cover the increased energy requirements. The "brown adipose tissue" that is specialised for so-called "non-shivering heat generation" increases with exposure to the cold and achieves a higher heating output." By keeping the mice at different temperatures over short and long periods - ranging here from a few hours to several months – the thermoregulatory efficiency and flexibility can be studied. Without any problems, **mice** can be trained to tolerate +5 °C without a negative energy balance developing. An animation on the web page of the **Institute for Molecular Nutritional Medicine** shows an example of how, with the help of computer tomography, the body composition of an anaesthetised mouse is examined non-invasively.

Keeping mice in Memmert constant climate chambers

In a clean room of the Institute for Molecular Nutritional Medicine, various strains and lines of mice are kept at +30 °C and at +5 °C, as well as 55 - 60 % relative humidity in two **Memmert constant climate chambers** HPP 750 in a "specified pathogen free" (SPF) state. In order to guarantee the recommended humidity of 45 - 65 % relative humidity for the proper housing of **mice** even at low temperatures, the **Memmert customisation department** integrated a compressed air drying unit arranged by the upper Bavarian laboratory specialist Zefa-Laborservice into the appliance. In addition, LED lighting with a timer enables a day and night rhythm to be simulated.

In conventional **temperature controlled cabinets**, **mice** and rats can only be kept at room temperature or warmer, since problems are generally associated with air exchange in combination with cooling and dehumidification. Walk-in

climate chambers with temperature and humidity control, as used by the **Institute for Molecular Nutritional Medicine** before they acquired the two **Memmert constant climate chambers**, have the disadvantage that above all working at +30 °C puts a strain on the animal caretaker staff. The new “mobile” solution is space-saving and enables freshwater to be supplied via water tanks, a further advantage, because normally, when **keeping mice**, there is no water connection to minimise the bacterial load. Via the appliance’s internal data logger, all controlled parameters can be logged and documented if required.

An overview of the main topics

- Adiposity, overweight, obesity
- Constant climate chamber
- myAtmoSAFE customised solutions
- Institute for Molecular Nutritional Medicine
- Technische Universität München
- Model organism mouse
- Physiology, cell biology, molecular biology
- Nutritional medicine

Laboratory equipment for incubation

Incubator I
Cooled incubator ICP
Peltier-cooled incubator IPP
CO2 incubator INCOmed
Cooled storage incubator IPS

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The **Institute for Molecular Nutritional Medicine** has outstanding connections in the national and international obesity research landscape. Among other things, the laboratory is a partner in the FP7 project DIABAT and the collaborative project ‘Molecular Mechanisms in Obesity’ in the German National Genome Research Network.

Further information and literature:
www.molekulare-ernaehrungsmedizin.de

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Picture credit: Memmert; geo_c/sxc.hu; alptraum/istockphoto

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