

**DOB:** 25<sup>th</sup> July 1978 at Echirolles, France

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Research Institute of Wildlife Ecology  
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**Current Position (2010-2014)**

**Post-doctoral position** at the Research Institute of Wildlife Ecology, Vienna, Austria

Research topic: Effect of n-6/n-3 polyunsaturated fatty acid ratio on hibernation, cardiac function and oxidative stress in heterotherms

**Energy Metabolism**

**Heterothermia**

**Small Mammals**

**Calorie Restriction**

**Stable Isotopes**

**Education**

**2007-2009. Assistant Lecturer and Researcher** (short-term contract, part-time)

Nancy University, France

*Department of Ecology, Physiology, Ethology – Hubert Curien Pluridisciplinary Institute, UMR 7178 CNRS-UdS Nancy*

Teaching field: Animal physiology

Research topic: Physiological and behavioral responses to a post-natal olfactory stress in rat (*Rattus norvegicus*)

**2004-2008. PhD in “Physiology, Biology of organisms and populations”**

University of Strasbourg, France (Grant of the French Minister)

*Department of Ecology, Physiology, Ethology – Hubert Curien Pluridisciplinary Institute, UMR 7178 CNRS-UdS Strasbourg*

Title: “Energy Saving Mechanisms in an Heterothermic Malagasy Primate: the Grey Mouse Lemur”

Date of defense: December 8<sup>th</sup>, 2008

Jury: Pr. Jean-Louis Gendraul (President; University of Strasbourg, France)  
Pr. Patricia Wright (Reviewer; Stony Brook University, New York, US)  
Dr. Dominique Desplanches (Reviewer; Claude Bernard University, Lyon, France)  
Dr. Stéphane Blanc (PhD Co-supervisor, CNRS, Strasbourg, France)  
Dr. Martine Perret (PhD Co-supervisor; CNRS, Brunoy, France)

**2003-2004. Master** in “Integrative Physiology in extreme conditions” Claude Bernard University, Lyon, France (Grant of the French Minister)

Main topic tackled: hyperbaria, hypoxia, microgravity, cold and heat exposure, muscular exercise

Master thesis: “Role of the system NMDA-receptor/Oxide nitric in the ventilatory acclimatization to chronic hypoxia in rat”

**2000-2003. Bachelor** in “Cell Biology and Physiology” (fourth year followed abroad at **Concordia University, Montréal, Canada**) at Joseph Fourier University, Grenoble, France

## Technical Skills

**Small mammals.** Laboratory housing and keeping, manipulations and experimentations

**Telemetry.** Body temperature and locomotor’s activity recordings in small mammals

**Respirometry.** Measurement of metabolic rates, determination of substrate-type oxidized

**Doubly labeled water.** Measurement of energy expenditure, water turnover, body composition

**Stable isotope labeling.** Macronutrient metabolism

**ELISA dosages.** Measurements of hormonal levels and metabolites (plasma and urine)

**Plethysmography.** Measurement of ventilatory flow in small mammals

**Behavioral tests.** Evaluation of learning and memory capacities, and stress levels

## Research activity – PhD thesis

My PhD training focused on seasonal **energy-saving strategies** used by the Grey Mouse Lemur (*Microcebus murinus*) to cope with a long-term food shortage, since this **heterothermic primate** has to face to both predictable and unpredictable food scarcities in its natural habitat. To highlight the nature and the limits of these **physiological adaptive mechanisms**, I exposed winter acclimated short-days (SD) and summer-acclimated long-days (LD) mouse lemurs to five weeks of an incremental (40 and 80%) food deprivation.

Initially, I followed by telemetry the changes in body temperature and locomotor’s activity of food-deprived mouse lemurs, which were individually implanted with a small data logger.

Notably, this technique allowed me to record animal's torpor bouts, which the expression increased only in SD food-deprived animals, allowing them to maximize their energy savings. Then, to highlight alternate energy-saving strategy, I measured food restriction-induced changes in metabolic rates and substrate-type utilization (assessed by doubly labeled water and respirometry), and in body composition (by using isotope dilution) of food-deprived animals. In particular, I resorted to isotope-labeled amino acids ( $^{15}\text{N}$ -glycine) to determine the protein turnover of mouse lemurs during the food deprivation. Food-deprived LD animals reduced their fat-free mass levels to lower their energy requirements whereas SD mouse lemurs preserved their lean mass, relying to fat mass during their increased torpor expression. Finally, I realized immuno enzymatic assays (ELISA) to determine the potential implications of gut-produced hormones in torpor expression of food-restricted mouse lemurs. I also followed the differential oxidations of saturated and polyunsaturated fatty acids (PUFA), by using isotope-labeled-lipids ( $^2\text{H}$ -palmitate and  $^3\text{H}$ -linoleate), in relation to the generation of markers of oxidative stress in the Grey Mouse Lemur. Based on the trade-off that would exist in heterotherms between increasing ability to express torpor and limiting oxidative stress generation during torpor, I demonstrated that only SD mouse lemurs under 40% energy restriction realized this trade-off, whereas the others increased oxidative damages. My PhD study therefore brings **new information and insights in the field of energy balance regulation** in mammals. More specifically, these findings deepen the **understanding of torpor control** in the Grey Mouse Lemur and bring new information concerning the relationship between **polyunsaturated fatty acids and torpor/hibernation expression** in heterotherms.

## Research activity - Assistant lecturer and researcher

Among mammals, **olfactory cues** play an **important role in the development of numerous behaviors**. In particular in rodents, the **olfactory channel** is the most **important sensorial avenue** for a number of functions including con-specific recognition, sexual, maternal and feeding behaviors... However, to date, little is known about the **behavioral long-term effects of an early olfactory deprivation**.

We therefore induced on young rats (*Rattus norvegicus*) a bilateral nasal obstruction (BNO) from post-natal *day 8* to *day 14*. To extend previous results on short-term BNO (9, 15 and 21 days) in rat, we investigated the effects, according to the sex, of an early nasal obstruction in adult rats. In particular, we realized the plus-maze and open-field tests to evaluate the anxiety and the exploratory behavior of the animals, as well as the multiple T-maze to determine the learning and memory capacities of the rats. In the same time, we evaluated the stress reactivity of the animals by measuring their corticosterone plasma levels. Finally, we measured the mass of their olfactory bulbs and other organs (adrenal glands, thymus, rate, liver, testicles, ovaries...) to evaluate the effects of an early olfactory deprivation in adult rats.

In the rat, post-natal BNO seems to trigger behavioral and physiological modifications in the adult, with differential consequences according to the sex. Complementary studies could precise these results and determine the responses of the BNO individuals to other various stresses.

**During this research work, I tutored two undergraduate students.**

## Research activity – Master projects

**January – July 2004. Master training** under the co-supervision of Pr Jean-Marc Pequignot and Dr Luc Denoroy  
Laboratory of integrative, cellular and molecular physiology (UMR 5123, Lyon)

### Role of the NMDA receptor/ nitrogen monoxide (NO) system in the ventilatory acclimatization to hypoxia in the rat

The project aimed to determine the implication of the positive feedback loop based on the receptor N-Methyl D-Aspartate (NMDA) to glutamate and the NO in the ventilatory acclimatization to hypoxia. By using the **plethysmography**, I performed measurements of the ventilatory responses to hypoxia (VRH) and tested the effect of an intra-peritoneal injection of an inhibitor of the NO synthase on the VRH. To measure the haematocrit and the proportion of the right ventricle of the heart, I realized samples of blood and cardiac tissues.

**January – July 2003. Master research project** under the supervision of Dr Dominique Garrel (Hôtel-Dieu hospital of the **University of Montreal**)

### Influence of anthropomorphic factors and those linked to burns on the basal metabolic rate of patients

Burn constitutes one of the most important stress factors for an organism, leading to a large increase in the energy expenditure of the patient. Therefore it appears crucial to determine the daily energy expenditure of the patients who undergo a burn injury, in order to estimate precisely their daily energy requirements. By using **respirometry**, I realized measurements of the basal metabolic rate of burned patients. Then, results were compared taking into account the anthropomorphic parameters and the size of the injury.

## Research activity – Expertise activities

**June 2005. Certificate of animal care and experimentation**, level 1, CNRS

**2005. Expert of the doubly labeled water method** in the research work of Dr Caroline Gilbert on the measurement of energy expenditure and body composition in newborn rabbits. This expertise led to the publication of a peer-reviewed article.

**2005. Expert of the respirometry method** in the research work of Dr Nassim Dali-Youcef on the measurement of energy expenditure in mice. This expertise led to the publication of a peer-reviewed article.

**2006. Organization of the 2<sup>nd</sup> Animal Behavior and Ecology Congress (SERL)** for European PhD students and youth researchers. 14-17 March 2006, Strasbourg, France.

## Teaching activities

**2007-09. Part-time of Assistant Lecturer in animal physiology** at Nancy University

**28 hours of courses** in 3<sup>rd</sup> year of undergraduate studies: respiratory physiology, blood physiology and homeostasis

**18 hours of courses** in 2<sup>nd</sup> year of undergraduate studies: preparation and correction of laboratory classes in nervous physiology

### **177 hours of laboratory classes**

- Nervous Physiology: Nervous action potential and its characteristics, effect of an anesthesia on the frog sciatic nerve; muscular and nervous action potentials and their characteristics; effects of curare, endogenous (acetyl-choline) and exogenous (nicotine) neurotransmitters on the sciatic nerve/gastrocnemien muscle preparation

- Circulatory and Respiratory Physiology: respiratory regulation (chemical, nervous) in rat, arterial pressure in rat: jugular and carotid canulations, *in situ* isolated heart of frog, cardiovascular pharmacology

**2008. Courses** in 2<sup>nd</sup> year of master “Eco-physiology and Ethology”  
Applications in stable isotopes in eco-physiology (4 hours)

**2006. Undergraduate teaching** at University of Strasbourg (14 hours)

**Animal biology.** Laboratory courses focused on dissections of invertebrates and realizations of drawings representing studied organisms

**2005. Undergraduate teaching** at University of Strasbourg (18 hours)

**Animal biodiversity.** Laboratory courses focused on theoretical concepts in sight to practical achievements (observations, dissections, drawings)

Topics: biodiversity animals, Phylogenetic, Lombric, Protists, Locust, Frog

## Publications

### Published

**Giroud S**, Blanc S, Perret M. Seasonal difference in energy-saving mechanisms during chronic food shortage in a Malagasy primate. *Comparative Biochemistry and Physiology A – Molecular and Integrative Physiology* 146(4): 79, Meeting Abstract, **2007**

Gilbert C, Blanc S, **Giroud S**, Trabalon M, Le Maho Y, Perret M, Ancel A. Role of huddling on the energetic of growth in a newborn altricial mammal. *American Journal of Physiology – Regulatory Integrative and Comparative Physiology* 293: 867-876, **2007**

Dali-Youcef N, Mataki C, Coste A, Messaddeq N, **Giroud S**, Blanc S, Koehl C, Chambon P, Fajas L, Metzger D, Schoonjans K, Auwerx J. Adipose tissue specific inactivation of the retinoblastoma protein protects against diabetes due to increased energy expenditure. *Proceedings of the National Academy of Sciences* 104(25): 703-708, **2007**

**Giroud S**, Blanc S, Aujard F, Bertrand F, Gilbert C, Perret M. Chronic food shortage and seasonal modulations of daily torpor and locomotor activity in the grey mouse lemur (*Microcebus murinus*). *American Journal of Physiology – Regulatory Integrative and Comparative Physiology* 294: 1958-1967, **2008**

**Giroud S**, Perret M, Le Maho Y, Gilbert G, Blanc S. Gut hormones in relation to body mass and torpor patterns changes during food restriction and re-feeding in the grey mouse lemur. *Journal of Comparative Physiology B – Biochemical Systemic and Environmental Physiology* 179(1): 99-111, **2009**

**Giroud S**, Perret M, Gilbert C, Zahariev A, Goudable J, Le Maho Y, Oudart H, Momken I, Aujard F, Blanc S. Dietary palmitate and linoleate oxidations, oxidative stress and DNA damage differ according to season in mouse lemurs exposed to a chronic food deprivation. *American Journal of Physiology – Regulatory Integrative and Comparative Physiology* 297: 950-959, **2009**

Gilbert C, McCafferty D, Le Maho Y, **Giroud S**, Blanc B, Ancel A. One for all and all for one: the energetic benefits of huddling in endotherms. *Biological Reviews* doi: 10.1111/j.1469-185X.2009.00115.x, **2009**

**Giroud S**, Perret M, Stein P, Goudable J, Aujard F, Gilbert C, Robin JP, Le Maho Y, Zahariev A, Blanc S, Momken I. The grey mouse lemur uses season-dependent fat or protein sparing strategies to face chronic food restriction. *PLoS One* (accepted), **2010**

### [In preparation](#)

**Giroud S.**, Perret M., Gilbert C., and Blanc S. The biology of the grey mouse lemur (*Microcebus murinus*): A unique model to study the strategies of energy economy in contrasted climates

## Communications

### [International](#)

**Giroud S**, Blanc S, Aujard, F, Bertrand F, Gilbert C, Perret M. Effect of Chronic Food Restriction on Daily Torpor and Locomotor Activity in a Seasonal Malagasy Primate: *M. murinus*. A Statistical Approach. **Oral communication** Neuroscience upper Rhine network (Neurex: Strasbourg, France; Freiburg, Germany; Basel, Switzerland). Workshop “The Forgotten Partner: The Statistical Tool”, Strasbourg, France; 19 June **2007**

**Giroud S**, Blanc S, Perret M. Seasonal Differences in Modulation of Heterothermic Phases in a Small Malagasy Primate – *Microcebus murinus* – Coping With a Chronic Food Shortage.

**Oral communication**

*The Society for Experimental Biology (SEB), Glasgow, Scotland; 31 March to 14 April 2007*

**Giroud S**, Reichardt F, Perret M, Le Maho Y, Gilbert C, Blanc S. “Gut Hormones in Relation to Body Mass and Torpor Patterns Changes During Food Restriction and Re-feeding in the Grey Mouse Lemur”. **Poster**

*The Society for Experimental Biology (SEB), Marseille, France; 6-11 July 2008*

**Giroud S**, Perret M, Blanc S. “Seasonal Differences in Energy Saving Mechanisms in Response to Chronic Food Restriction, in a Heterothermic Malagasy Primate: *Microcebus murinus*”. **Oral communication**

*13<sup>th</sup> International Hibernation Symposium (IHS), Swakopmund, Namibia; 6-12 August 2008*

Gilbert C, Boivin S, Padzys G.S, Erbrech A, **Giroud S**, Trabalon M. “Long-term Behavioural Impacts of an Early Olfactory Deprivation”. **Poster**

*International Ethological Conference (IEC), Rennes, France; 19-24 August 2009*

Gilbert C, **Giroud S**, Padzys G.S, Martrette J.M, Boivin S, Trabalon M. “Short and long-term behavioural and physiological effects of a postnatal olfactory deprivation”. **Poster**

*XIX European Chemoreception Research Organization Congress, Villasimius, Cagliari, Italy; 24-27 September 2009*

## National

**Giroud S**, Blanc S, Perret M. Différences saisonnières des mécanismes d'économie d'énergie en réponse à une restriction calorique au long cours, chez un primate malgache. **Oral communication**

*19<sup>th</sup> Congress of the French Society of Primatology (SFDP), Strasbourg, France; 18-20 October 2006*

Gilbert C, Aujard F, Perret M, Blanc S, Le Maho Y, **Giroud S**, Ancel A. Régulation de la température interne chez le manchot empereur en reproduction. **Poster**

*40<sup>th</sup> Congress of the French Society of Chronobiology (SFC), Caen, France; 4-6 June 2008*

## Personal Interests

2001 - ... Active member in a mountain club located at Grenoble, France – <http://alpesclub.free.fr>

**Mountaineering sports.** Rock and ice climbing, via ferrata, alpinism, hiking, snow rackets, mountaineering ski and bike...

**Music.** Music theory and oboe