



CiMUS International PhD Programme

1. Project title:

Genetic and chemical partial reprogramming of obesity and metabolic syndrome

2. Research Project:

Cell reprogramming by defined genetic factors has demonstrated that somatic differentiated cells can undergo drastic phenotypic transformation to revert to a pluripotent embryonic state. This induction of pluripotency is accompanied by profound cellular rejuvenation through extensive remodeling of the epigenetic landscape. Originally described as occurring in vitro following expression of the four genetic factors Oct4, Sox2, Klf4, and c-Myc (collectively termed OSKM), it is now established that these factors can be replaced by a complex cocktail of chemical compounds and that reprogramming can occur in vivo in mice. Furthermore, short cyclic expression of OSKM results in cellular rejuvenation in vitro and organismal rejuvenation in vivo. Our laboratory has extended these findings by demonstrating that a subset of reprogramming chemical compounds is sufficient to induce rejuvenation.

Obesity constitutes a primary driver of metabolic syndrome, a cluster of conditions that significantly increases the risk of developing type 2 diabetes, cardiovascular disease, stroke, and metabolic dysfunction-associated steatotic liver disease. These interconnected health complications ultimately compromise both quality of life and life expectancy. Although obesity represents a multifactorial health disorder, an altered epigenetic state is increasingly recognized as a contributing factor to its pathogenesis. Resetting the epigenetic landscape associated with obesity may therefore exert profound effects on metabolic syndrome development.

We have already obtained compelling experimental evidence demonstrating that partial reprogramming in obese mice ameliorates metabolic syndrome without apparent adverse effects. In this research project, we aim to expand upon these preliminary observations by investigating the potential health benefits derived from genetic and chemical partial reprogramming in obese mice, specifically assessing the impact of these interventions on metabolic syndrome parameters. We will employ an integrated approach utilizing genetic mouse models, reprogramming chemical cocktails, novel vehicles for targeted delivery of reprogramming factors, and multi-omics analyses to elucidate the molecular mechanisms by which cellular reprogramming alleviates metabolic syndrome.



3. Job position description:

Key Responsibilities:

- Perform and optimize experimental work using cellular and animal models.
- Analyze and interpret molecular and physiological data.
- Critically review scientific literature.

Requirements for candidates:

- Strong academic background in biomedical sciences.
- High level of motivation, scientific curiosity and analytical skills.
- Previous hands-on laboratory experience is highly desirable, particularly in techniques such as cell culture, molecular biology or animal experimentation.

4. Supervisor and Co-Supervisor

Name: Manuel Collado

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Research group: Cell Senescence, Cancer and Aging

Link to the group website:

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Name: Sulay Tovar

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