# Linear Models: Homework 1

2024-2025

The homework is individual work. On Blackboard you find the data file and a R Markdown template that you should use for this homework. You have to submit both the pdf and the Rmd file. Please submit your report via BB Assignments and give your files names of the following format:

LastName_FirstName_HW1.pdf
LastName_FirstName_HW1.Rmd

You really have to submit both files!

Important notes about the use of the R Markdown file:

- Replace "Your name" with your name
- There are two major sections: "Answers to the questions" and "Appendix with R code":
  - Answers to the questions: here you write the answers to the questions (concisely, to-the-point and in neat English).
    This section may NOT contain any R code.
  - Appendix with R code: this part contains your R code to support your answers.

## Question 1

Immunoglobulins in the blood are known to protect against diseases. We consider a pre-clinical study in which a potential new drug, a chemical compound with the name ADDF17, is evaluated for negative side effects. One of these effects, could be its negative effect on the blood serum levels of Immunoglobulin IgG1. Healthy mice have IgG1 blood serum concentrations between 1.2 and 5 mg/l.

A lab animal experiment is set up with 62 mice. For each of the following doses of ADDF17, twelve mice were included in the study: $0.025\mu g$, $0.075\mu g$, $0.1\mu g$, $0.2\mu g$, and $0.5\mu g$. For a dose of $2\mu g$ only 2 mice were included. The data are given in the R data file mice.RData.

You are asked to perform statistical analysis for answering the following research questions:

a What is the effect of the concentration of ADDF17 on the mean IgG1 blood level concentrations?

b Give an appreciation/interpretation of the (im)precision of the previous estimate (standard error and a 95% confidence interval).

c Is there a significant effect of the concentration of ADDF17 on the mean IgG1 blood level concentrations at the 5% level of significance? What is the null and alternative hypothesis considered, and give a motivation for you choice.

d Repeat the data analysis, but without the data of the mice that received a dose of $2\mu g$. No need to give a detailed conclusion, but only report on the major differences in the conclusion and explain this difference.

# Question 2

Consider the R code provided to you in the R Markdown file. What do you conclude from this simulation study. Your answer should be formulated in less than half a page (hence no need to describe the R code, only formulate your conclusion).