**Title:**

**Health and disease imprinted in the time variability of the human microbiome**

**Running Title:**

**Microbiota, are you sick?**

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### modificar becas de JMM y DMM ¿poner algún grant más?

**Abstract:**

**Human microbiota plays an important role in determining changes from health to disease. Increasing research activity is dedicated to understand its diversity and variability. We analyse 16S rRNA and whole genome sequencing (WGS) data from the gut microbiota of 97 individuals monitored in time. Temporal fluctuations in the microbiome reveal significant differences due to factors that affect the microbiota such as dietary changes, antibiotic in- take, early gut development or disease. Here we show that a fluctuation scaling law describes the temporal variability of the system and that a noise-induced phase transition is central in the route to disease. The universal law distinguishes healthy from sick microbiota and quantitatively characterizes the path in the phase space, which opens up its potential clinical use and, more generally, other technological applications where microbiota plays an important role.**

### word-count (WC) = 135/250

**###**

**Importance** (it is very important to write this section in a proper way):

Human microbiota is tightly associated to the health status of a person. Here we analyse the microbial composition of several subjects under different conditions, over a time span that ranges from days to months. Using the Langevin equation as a basis of our mathematical framework in order to evaluate microbial temporal stability, we prove that we are capable to distinguish stable from unstable microbiotas. This first step will help us to determine how microbiota stability is related to the healthiness of the people, and it will allow the development of a more complete framework in order to deepen the knowledge of this complex system.

###WC = 120/150

**Keywords**: microbiome, systems biology, ecological modelling, community composition, stability

**Introduction**

**Material and Methods**

**Results**

**Discussion**

**Acknowledgements**

All hail the hipnotoad!

**Funding information**

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**Conflict of Interest**

Authors declare that there are no competing financial interests in relation to the work described here.