

DECRO SYSTEM FOR ENHANCED CIRCADIAN RHYTHM PHENOTYPING IN RATS

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Jacketed monitoring for life sciences

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Introduction

- Actograms are useful tools to assess circadian rhythm and model's phenotypes especially in neuroscience field.
- Combining cardiorespiratory parameters to this actogram could become an added value but yet require setup invasive (telemetry implant) or restraining (plethysmography)

Aim : Evaluate if the novel DECRO™ telemetry jacket could be a useful technic to monitor circadian patterns alterations on cardiac, respiratory and spontaneous activity in freely-moving rats.

Material and methods

Animals :

- Reanalysis of data from 8 Sprague Dawley adult rats (229-256 g) used in a safety pharmacology study [1]
- Divided in two groups (Vehicle and Baclofen 15 mg/kg P.O.).
- 2 habituation sessions to the jacket were conducted the week before the experiment day as recommended in [2].

Experimental Procedure :

24 hour recording of Heart Rate (HR), Respiratory Rate (RespR) and Spontaneous Activity (SA) in pair housing with a 12-hour Light/Dark cycle :

- 8 am: fitting animals with the DECRO Bluetooth-based, external jacketed telemetry device
- 10 a.m: P.O. administration of drug / vehicle
- 6 pm: Dark switch and batteries replacement
- 8 am D+1: Jacket removal

Data Recording and Analysis (DECRO 2.0.0 software):

- Physiological parameters calculated using the software
- Dark / Light periods labelled excluding manipulations periods (ie dosing, battery change...)
- Data averaged and significance assessed with Paired T-Test (Python Pinguin 0.5.0)

Results

Control group :

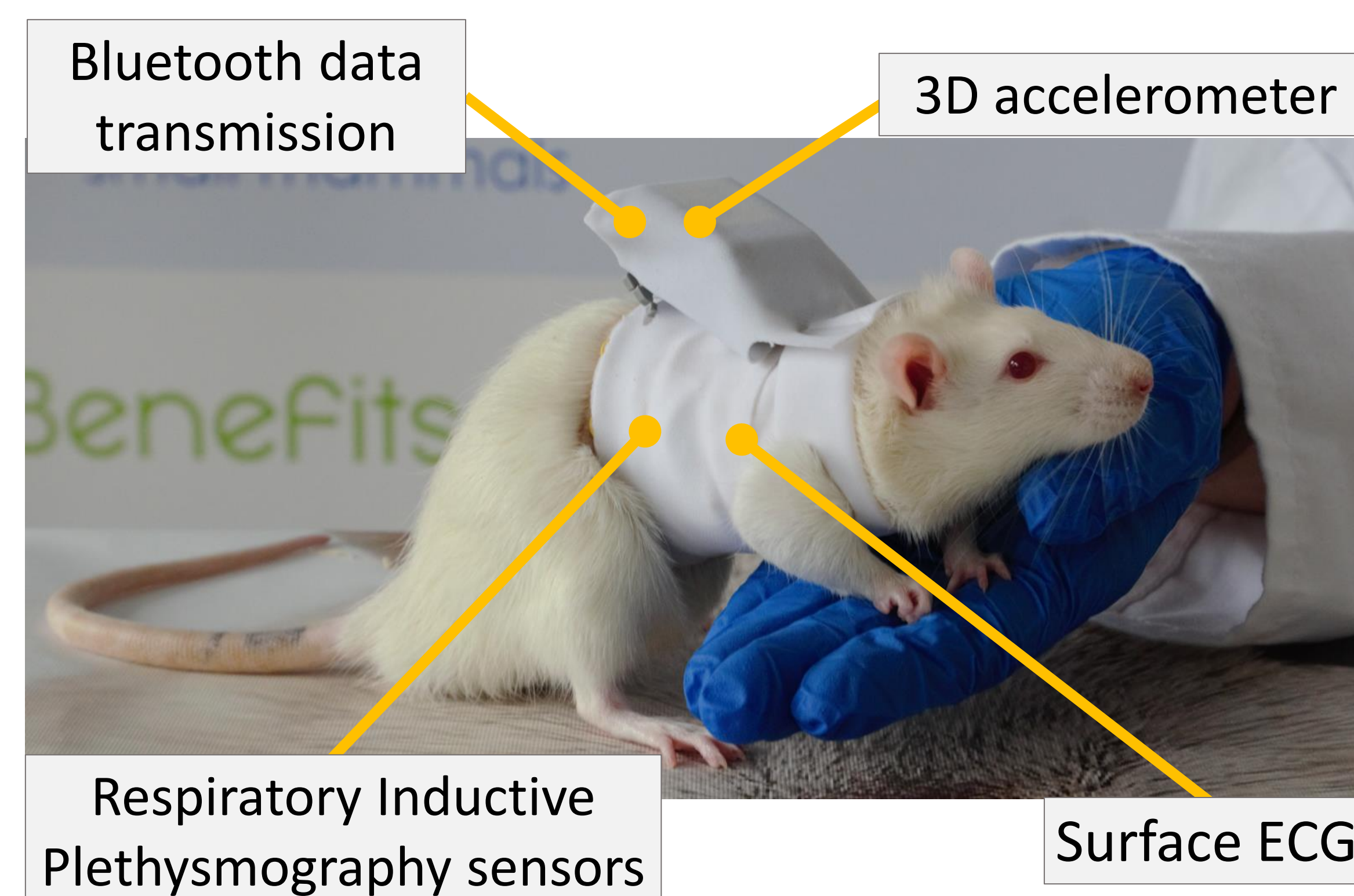
- Significantly higher ($p < 0.05$) Spontaneous Activity during dark period (active period for rats) than during the light period (+22 mg / +133%).
- HR and RespR followed the same trend with an increase during dark period (+33 bpm / +8% ; +9 bpm / +6%; respectively).

Baclofen group:

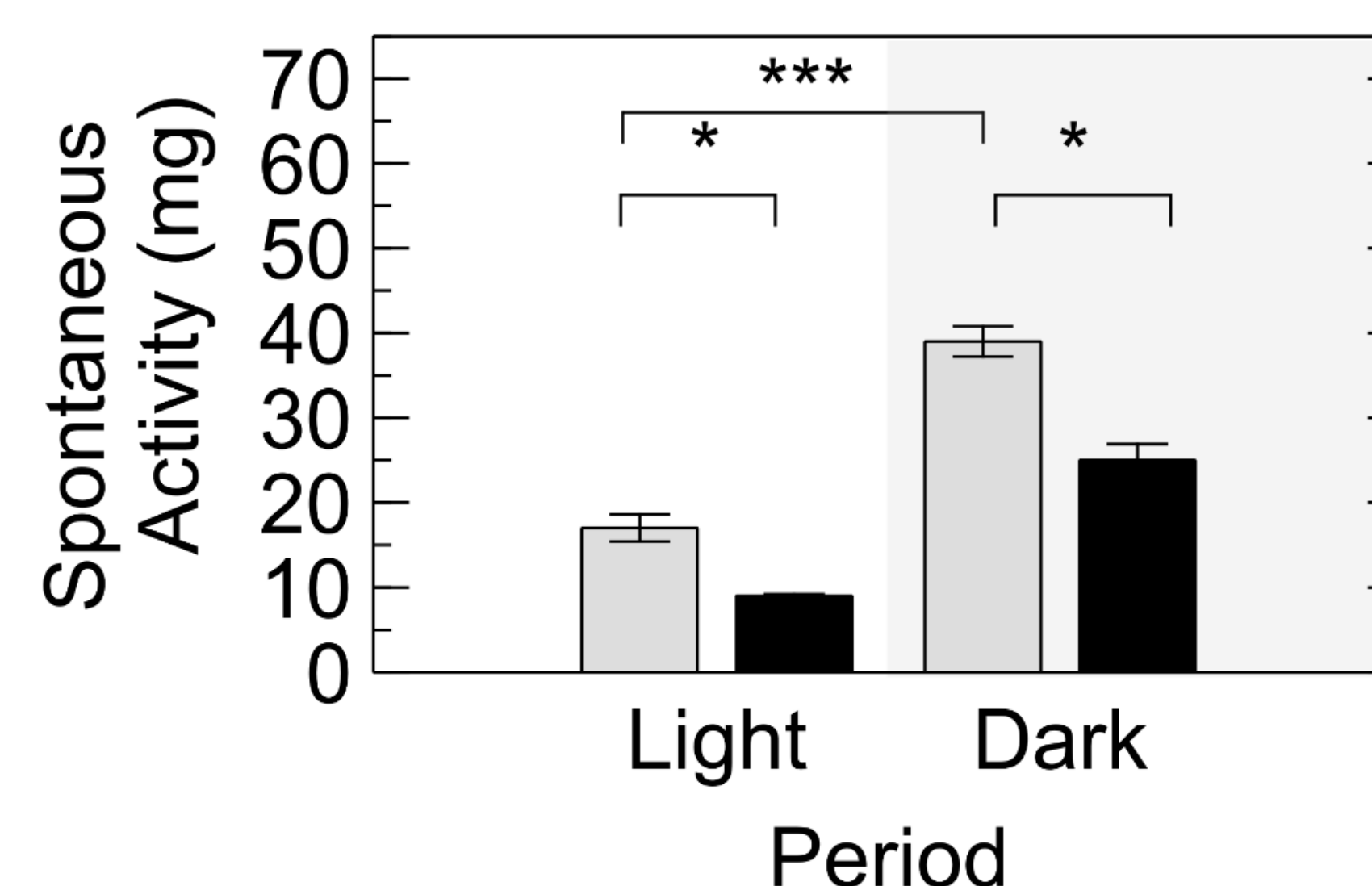
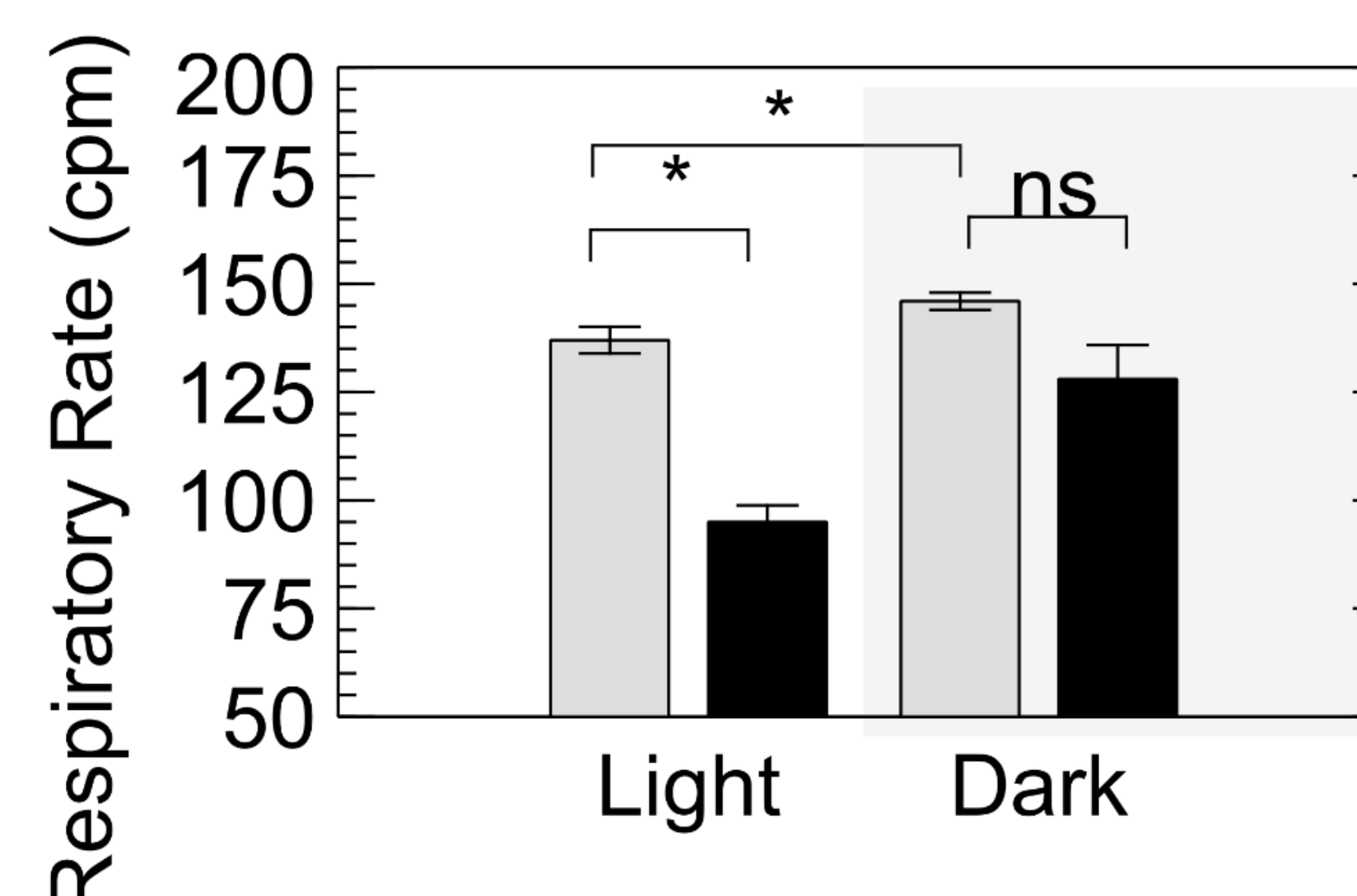
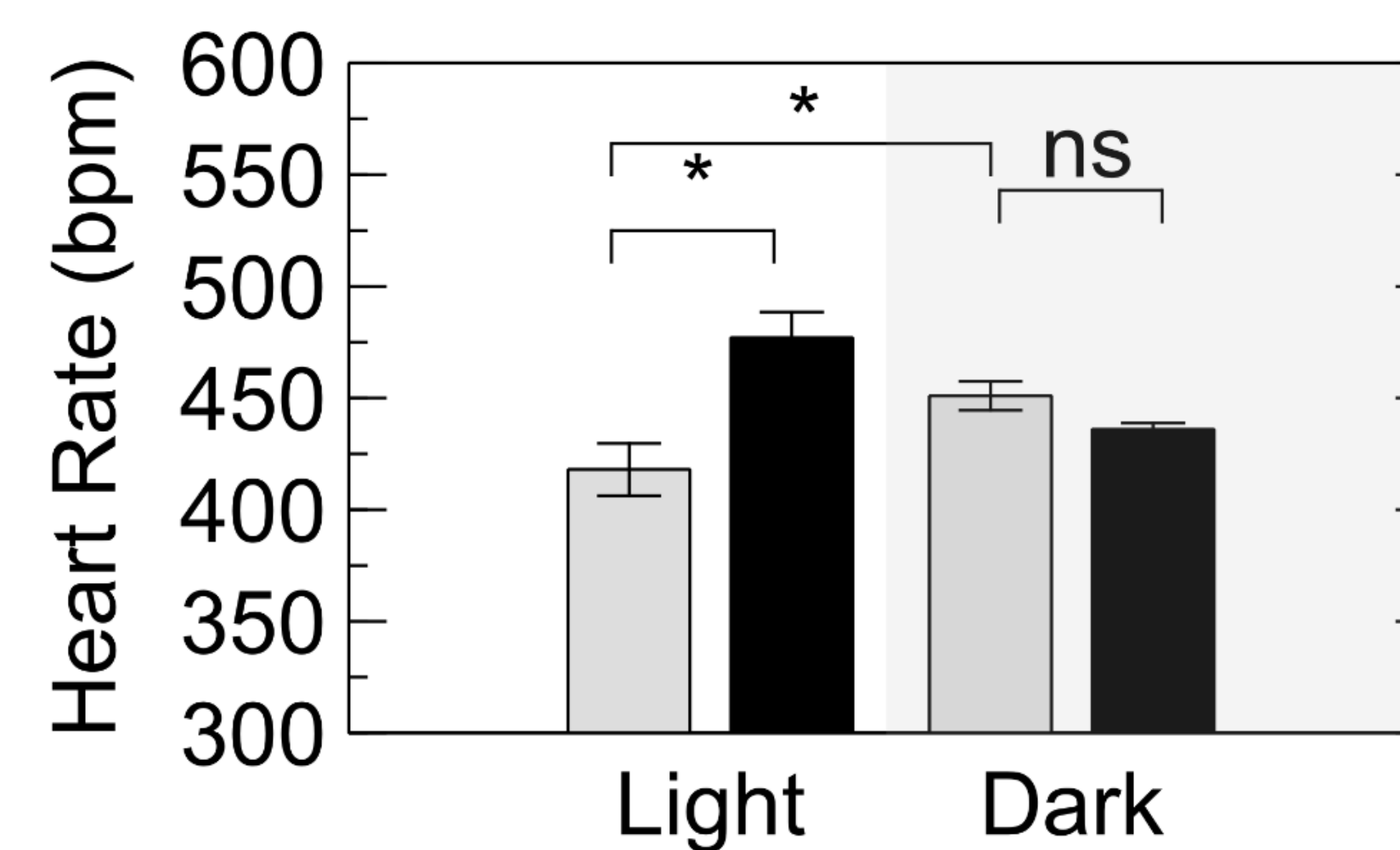
- Baclofen induced Tachycardia (HR \uparrow) and Respiratory depression (RespR \downarrow) and activity (SA \downarrow) decrease during Light period (as expected) with a recovery of Heart Rate and Respiratory Rate value occurring (ns difference during dark period)
- Circadian rhythm signature altered by the pharmacological effect of the compound (activity depressant) \rightarrow Although Spontaneous Activity increased during the dark period, its magnitude was significantly lower than in the control group ($p = 0.0017 < 0.05$)

Conclusions

- The DECRO jacket can detect spontaneous activity and cardiorespiratory changes whether being related to circadian rhythm or to a test compound in rats.
- This novel non-invasive approach enables physiological monitoring in group housed animals in line with the 3Rs
- Such an external telemetry system that can be used in combination with behavioral assessment system / protocols



(Fig.1) An Animal equipped with DECRO jacket embedding respiratory inductive plethysmography sensors, Ag/AgCl electrodes are stuck on a clipped area (under the jacket) and a Bluetooth electronic transmitter connected to the sensors is placed into the backpack.



* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

Control (n=4)
Treated (n=3)

(Fig.2) Heart Rate (HR), Respiratory Rate (RespR) and Spontaneous activity parameters presented as average \pm sem for light and dark periods.

References

- [1] Fares, R., Flénet, T., Vial, J., Ravaz, M., Roger, V., Bory, C., & Baudet, S. (2022). Non Invasive Jacketed Telemetry in Socially-Housed Rats for a Combined Assessment of Respiratory System, Electrocardiogram and Activity Using the Decro System. SSRN Electronic Journal. <https://doi.org/10.2139/ssrn.4064497>
- [2] Fares, R., Boire, A., Eynard, C., & Flénet, T. (2020). Simultaneous non-invasive telemetric electrocardiogram and respiratory measurement with a connected jacket (DECRO system) in rats. Protocol Exchange. <https://doi.org/10.21203/rs.3.pex-860/v1>

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