IBMS1 – Tutorial 2.7.2

Negative feedback and rhythms in the HPA axis

Learning objectives

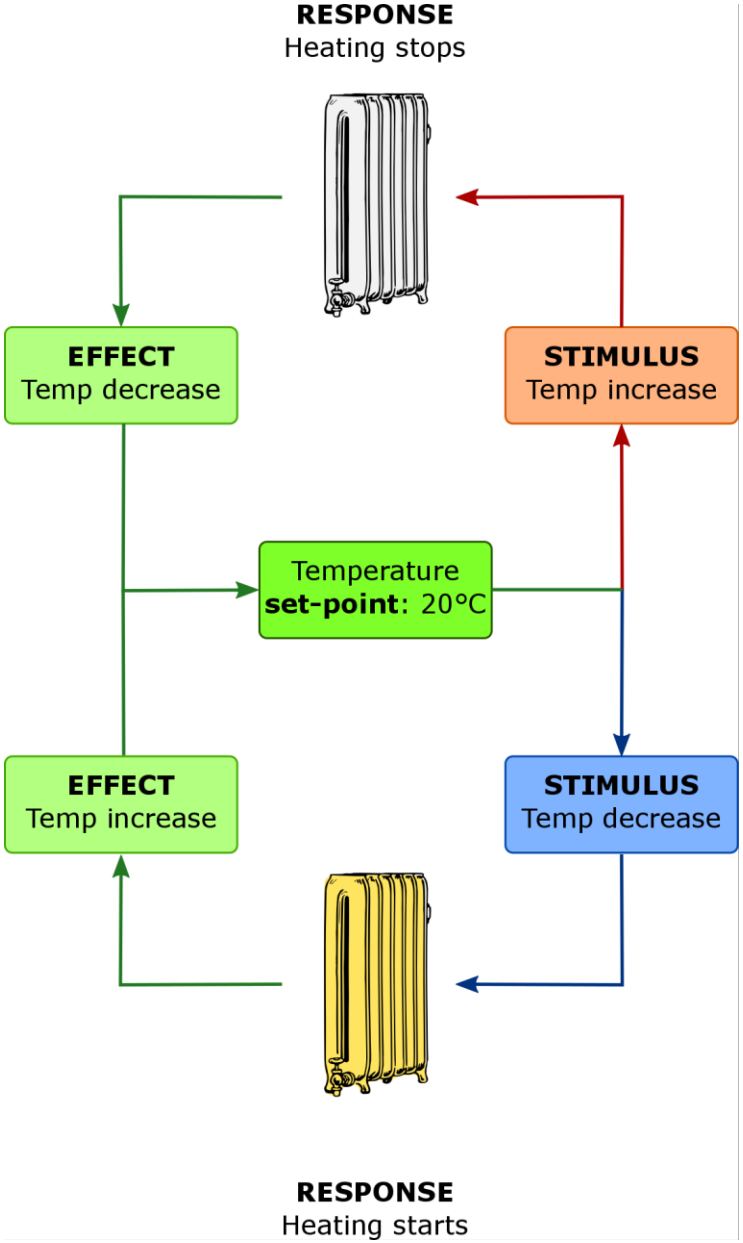
This tutorial will allow you to:

1. Describe the temporal relationships between hormones of the stress axis (hypothalamus-pituitary-adrenal, or HPA)

2. Describe how pulses of hormone are generated because of negative feedback

3. Outline how an acute stress can perturb HPA pulsatility.

An example of negative feedback



Task 1

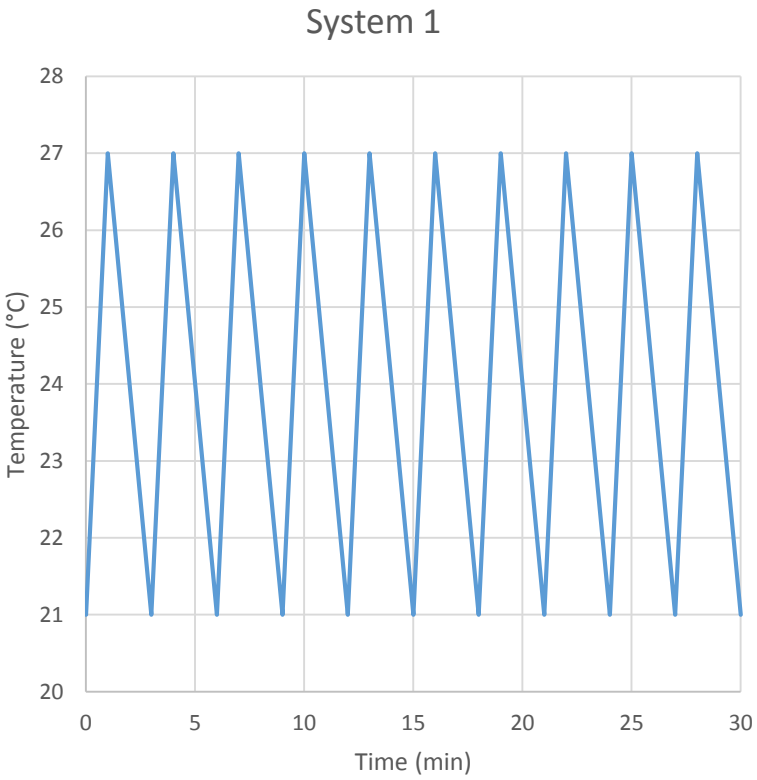
1. Split into 2 groups

2. You will be given instructions to simulate an heating system

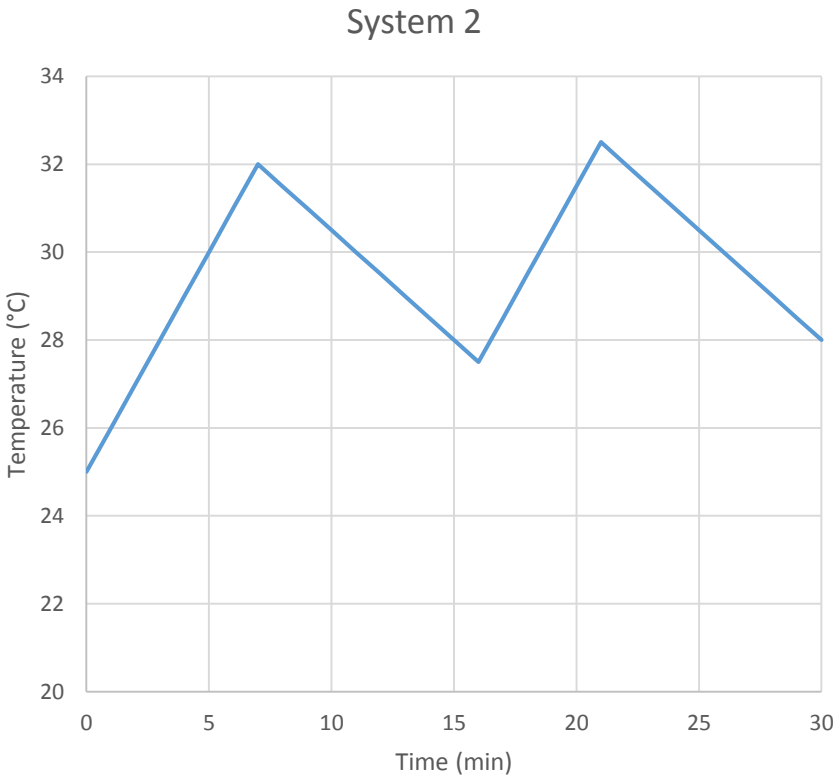
3. Each groups will use their set of instructions to produce a graph of changes in temperature over time
(about 10 minutes)

4. Once finished discuss the similarities and differences
(about 5 minutes)

Task 1



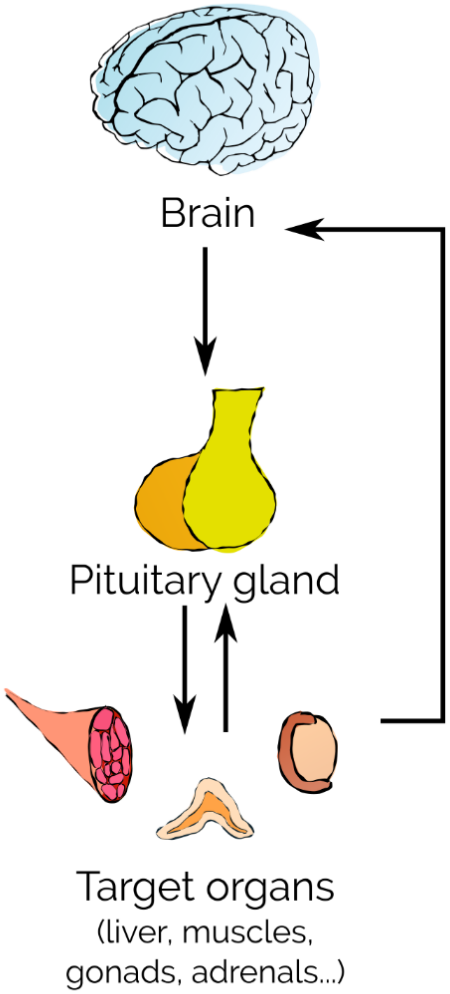
Set-point 25˚C

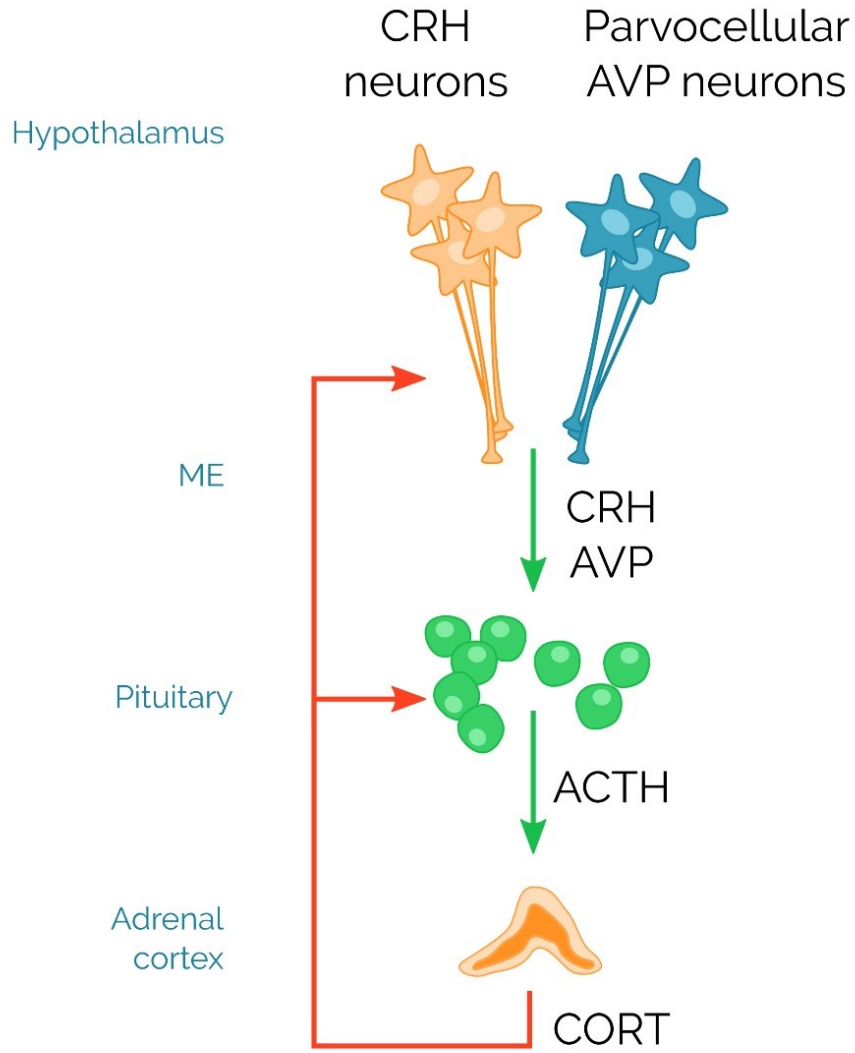


Set-point 30˚C

Task 2 and 3

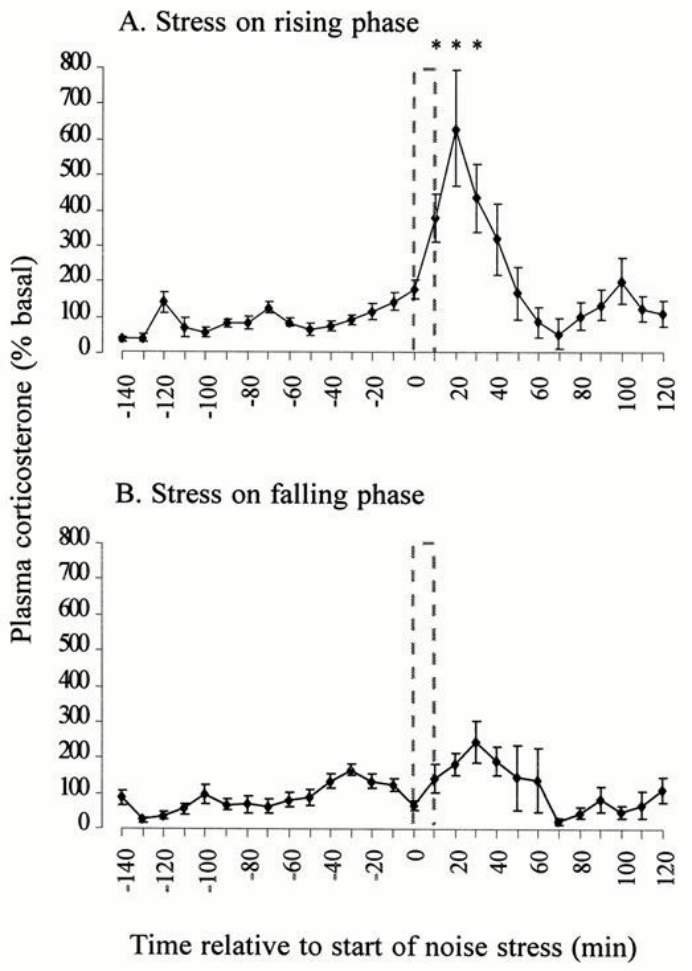
We will now look at a biological example of negative feedback





Task 3

Real data of CORT levels in rats exposed to a stressor (noise) during the rising or falling phase of CORT rhythm.



Windle et al., Endocrinology 1998

Summary

- Biological (and non biological) systems where negative feedback is in place can display pulsatility

- The specific “rules” of the system determine the characteristics of the pulses, such as amplitude and length (and whether you have any pulses at all!)

- The complex dynamics of the systems can influence how it responds to new challenges

- Remember: this was a **very simplified** model of the HPA axis. In reality many more variables come into play and makes understanding the interactions in the system much more complex.