

# **The Autonomic Nervous System and Resiliency**

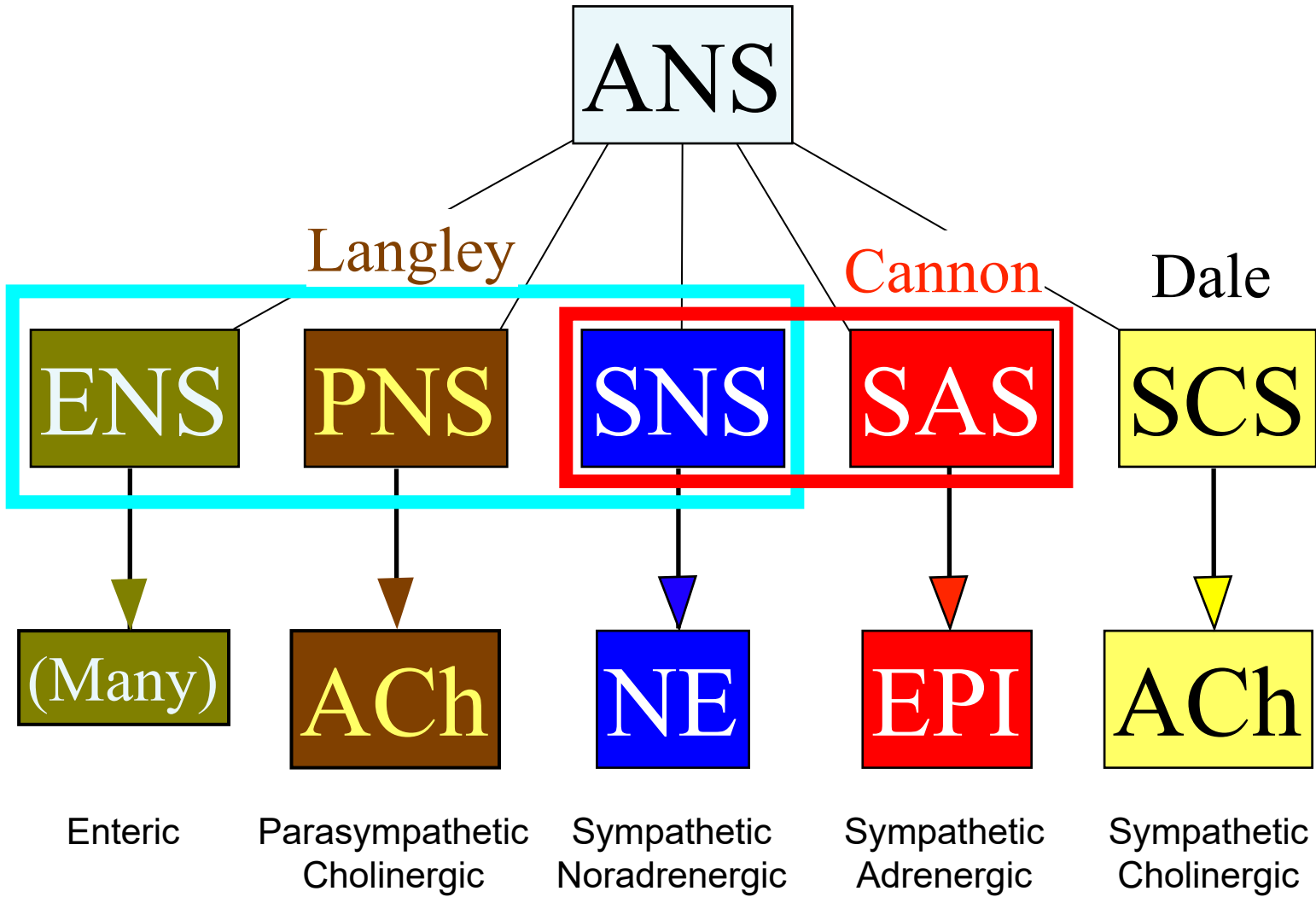
David S. Goldstein

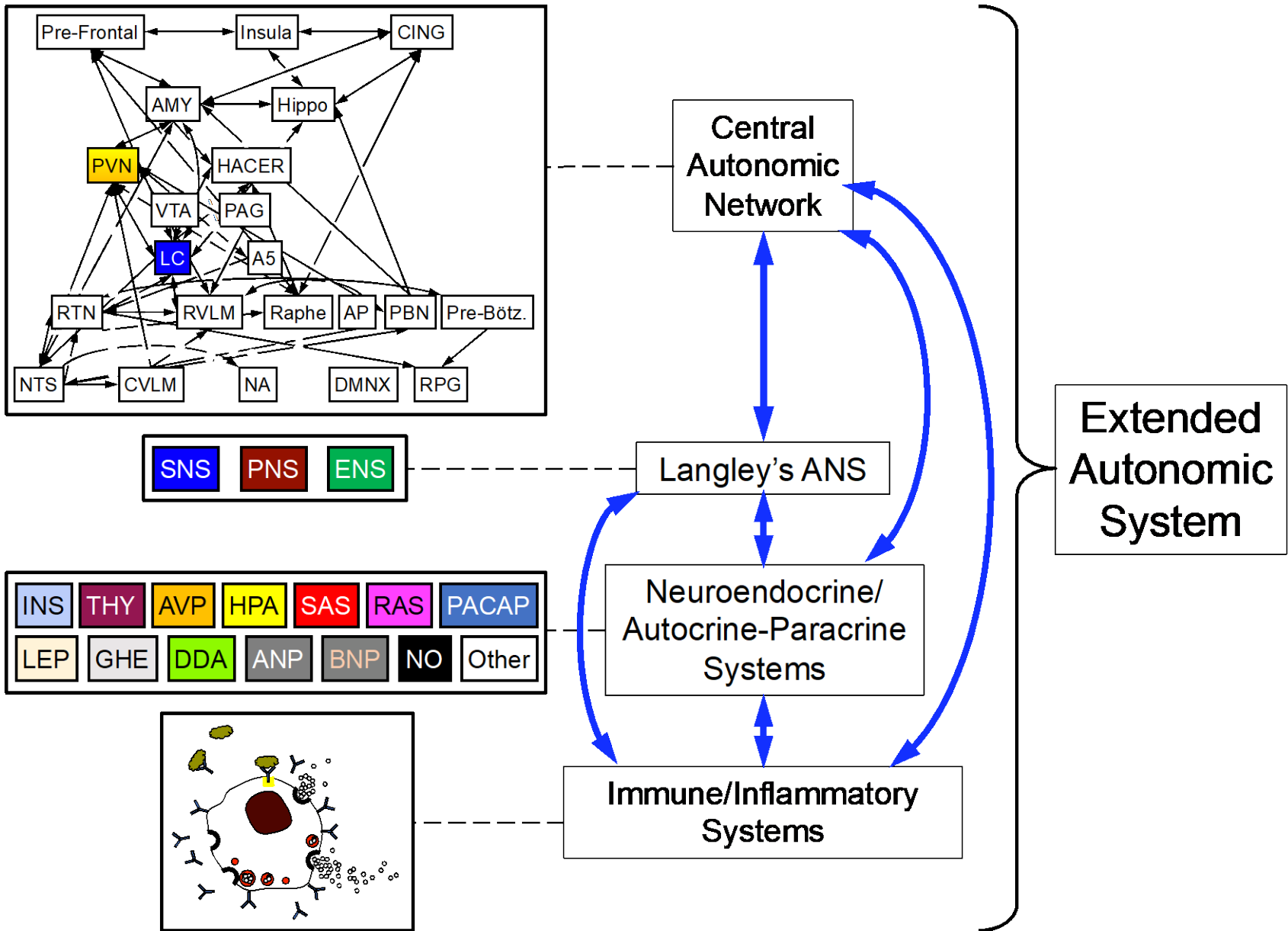
*Autonomic Medicine Section*

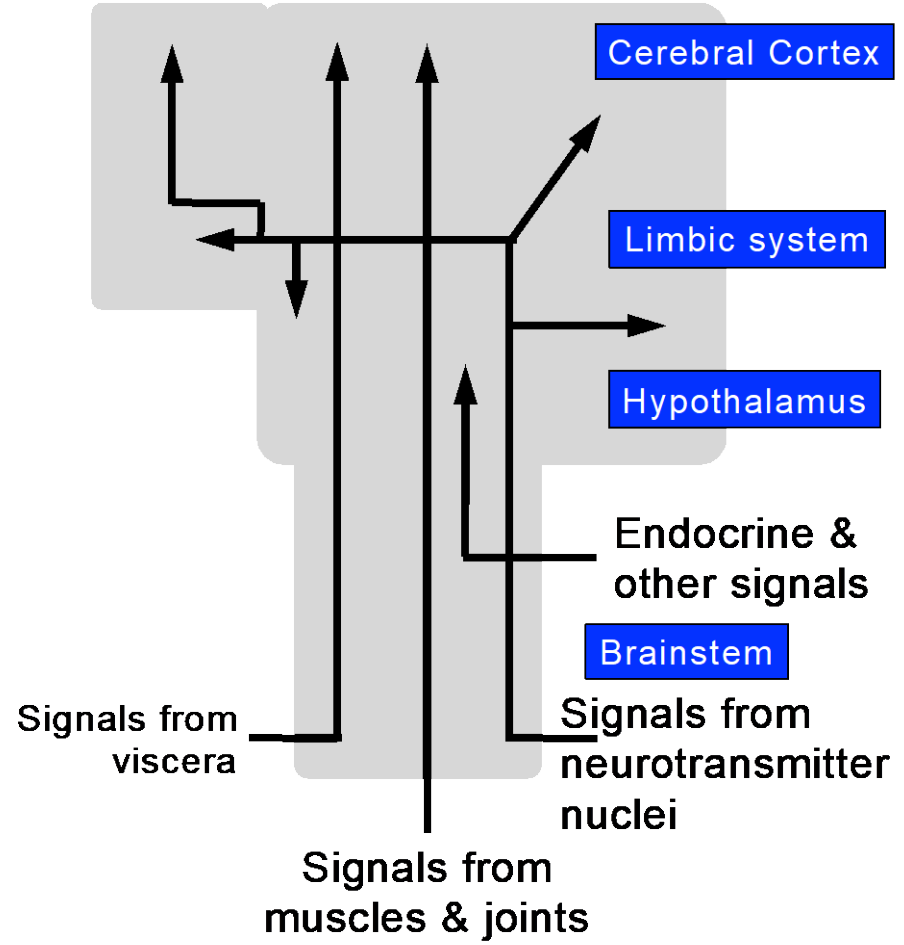
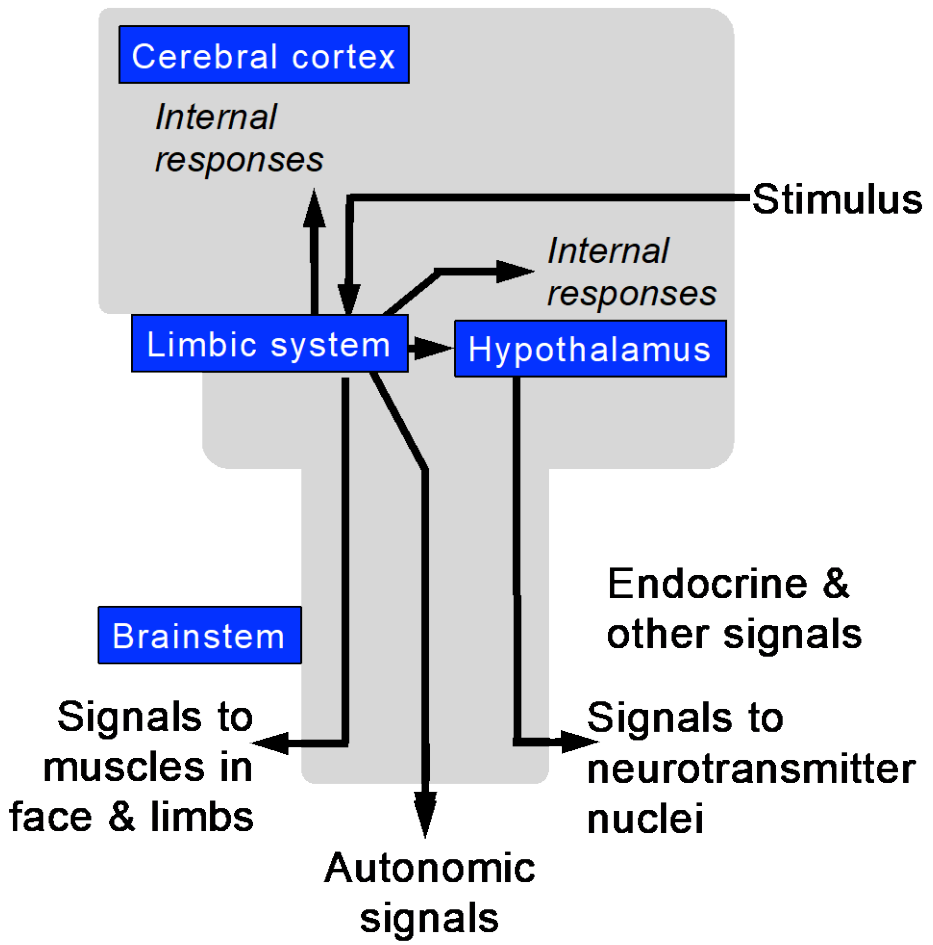
*CNP/DIR/NINDS*

*National Institutes of Health*

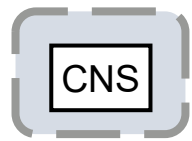
*Bethesda, MD*







*Adapted from Damasio, A. Descartes' Error. Emotion, Reason, and the Human Brain  
NY: Avon Books, Inc. 1994*

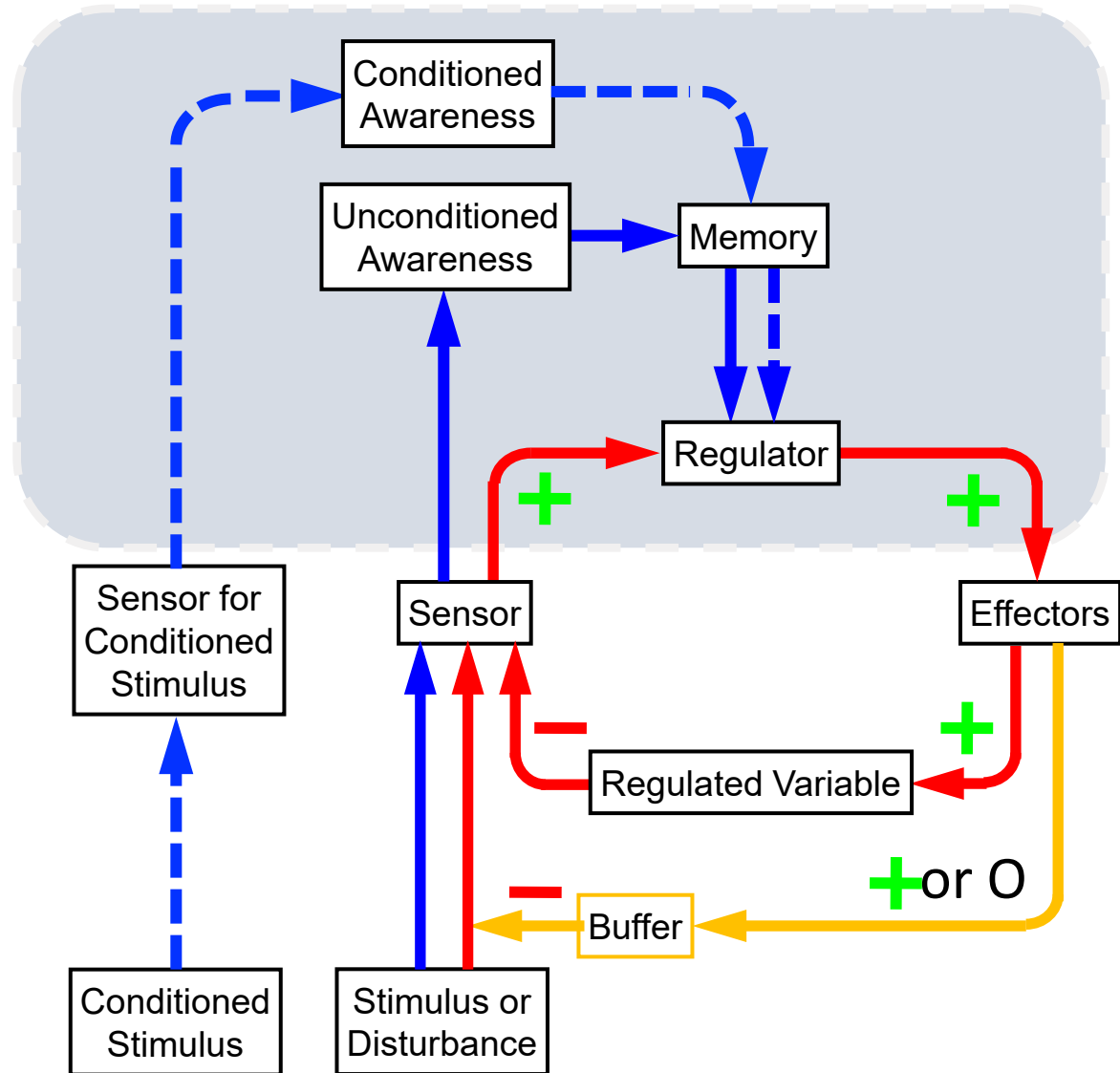


**—**  
Error Control  
(Negative Feedback  
Reflexive)

**—**  
Anticipatory  
(Feed-forward  
Instinctive)

**- - -**  
Anticipatory  
(Feed-forward  
Conditioned)

**—**  
Buffering



SELYE JÁNOS • 2. STRESSZ VILÁGKONFERENCIA, BUDAPEST

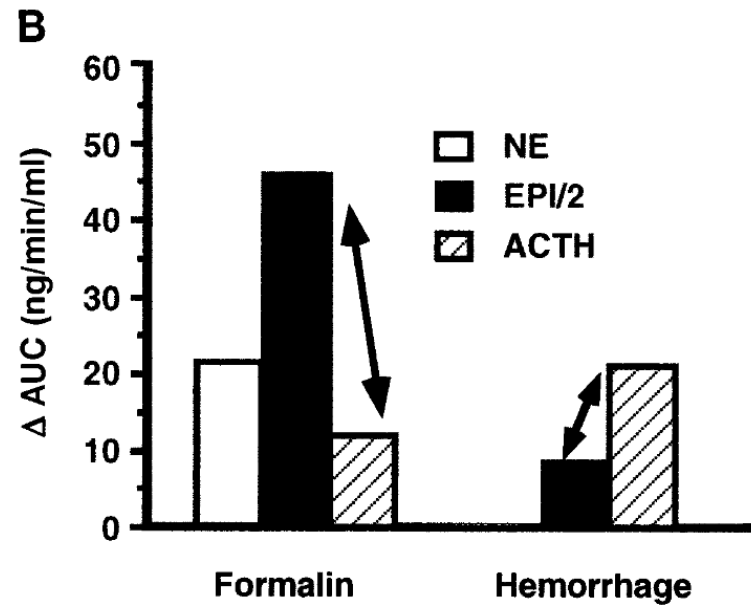
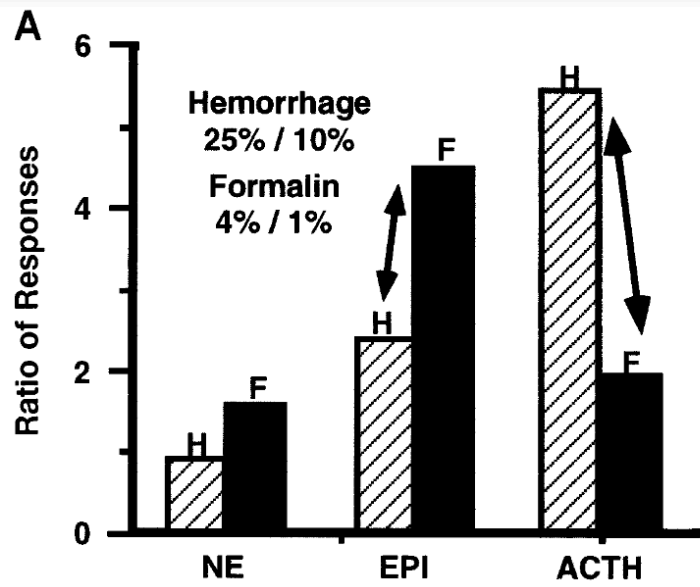
100 ÉVE SZÜLETETT

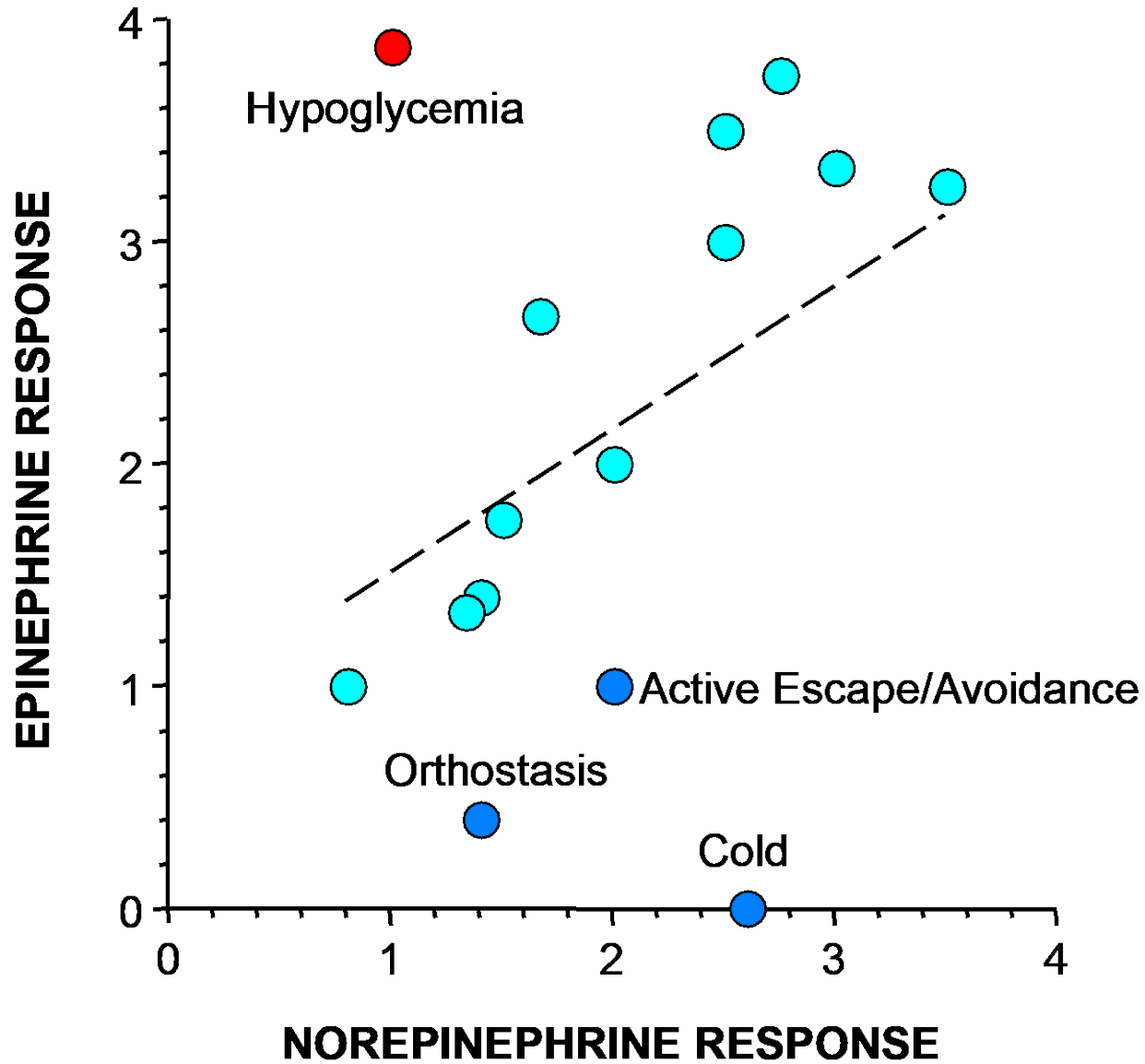


400<sup>Ft</sup>

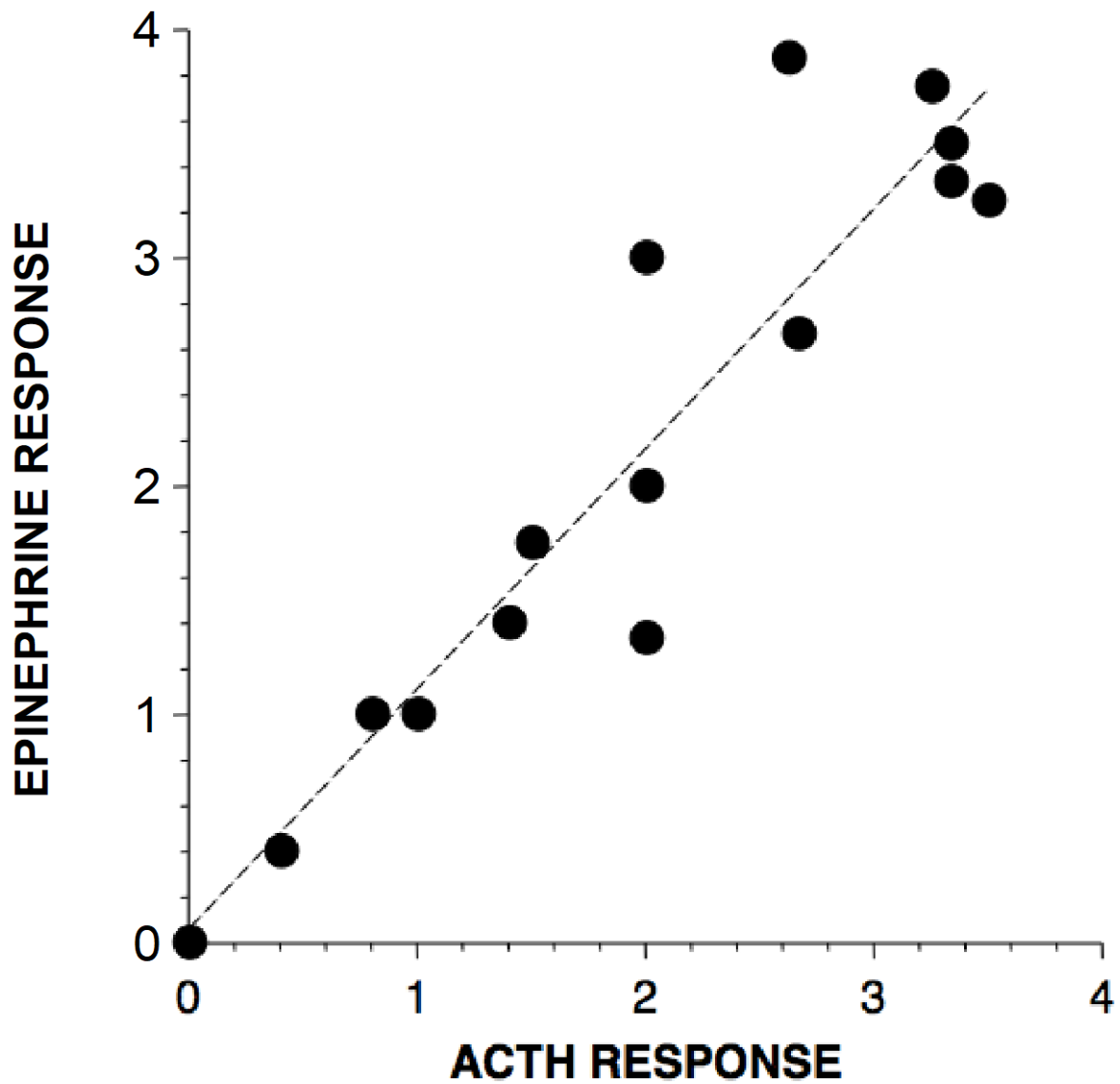
MAGYARORSZAG

Nagy P. • ÁNy.Nyrt. 2007









SNS

SAS

2-Deoxyglucose (glucoprivic stress)

+

++++

Distress

+

+++

Autonomically mediated syncope (fainting)

+

++++

Orthostasis

++

+

Mild exercise

++

+

Cool temperature at skin of back

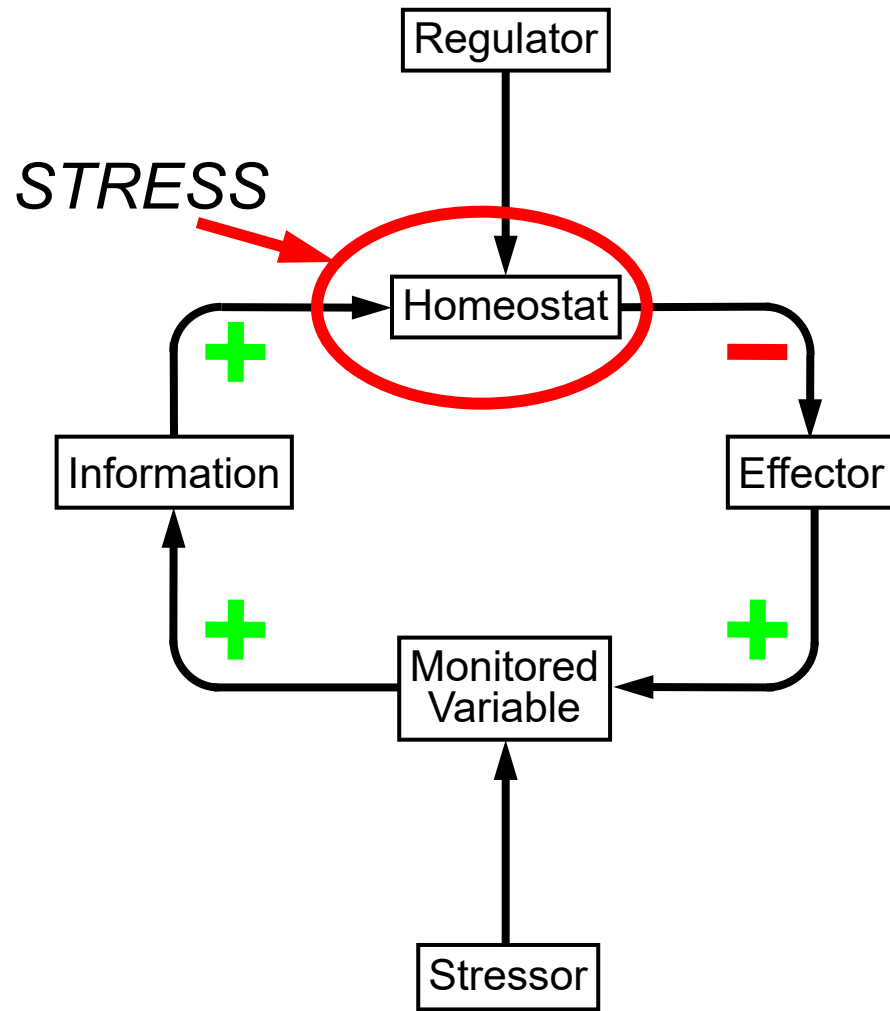
+

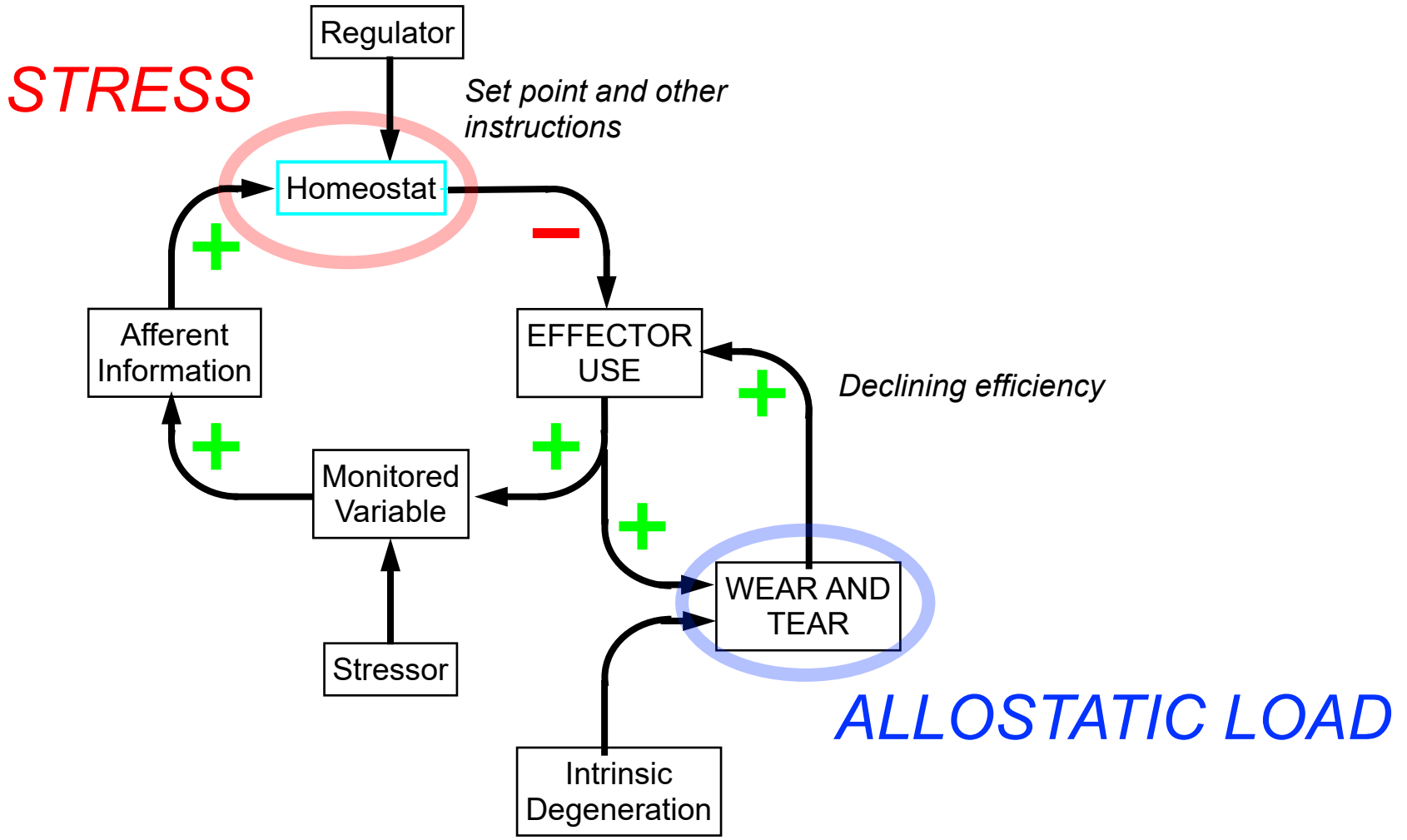
0

Mild core hypothermia

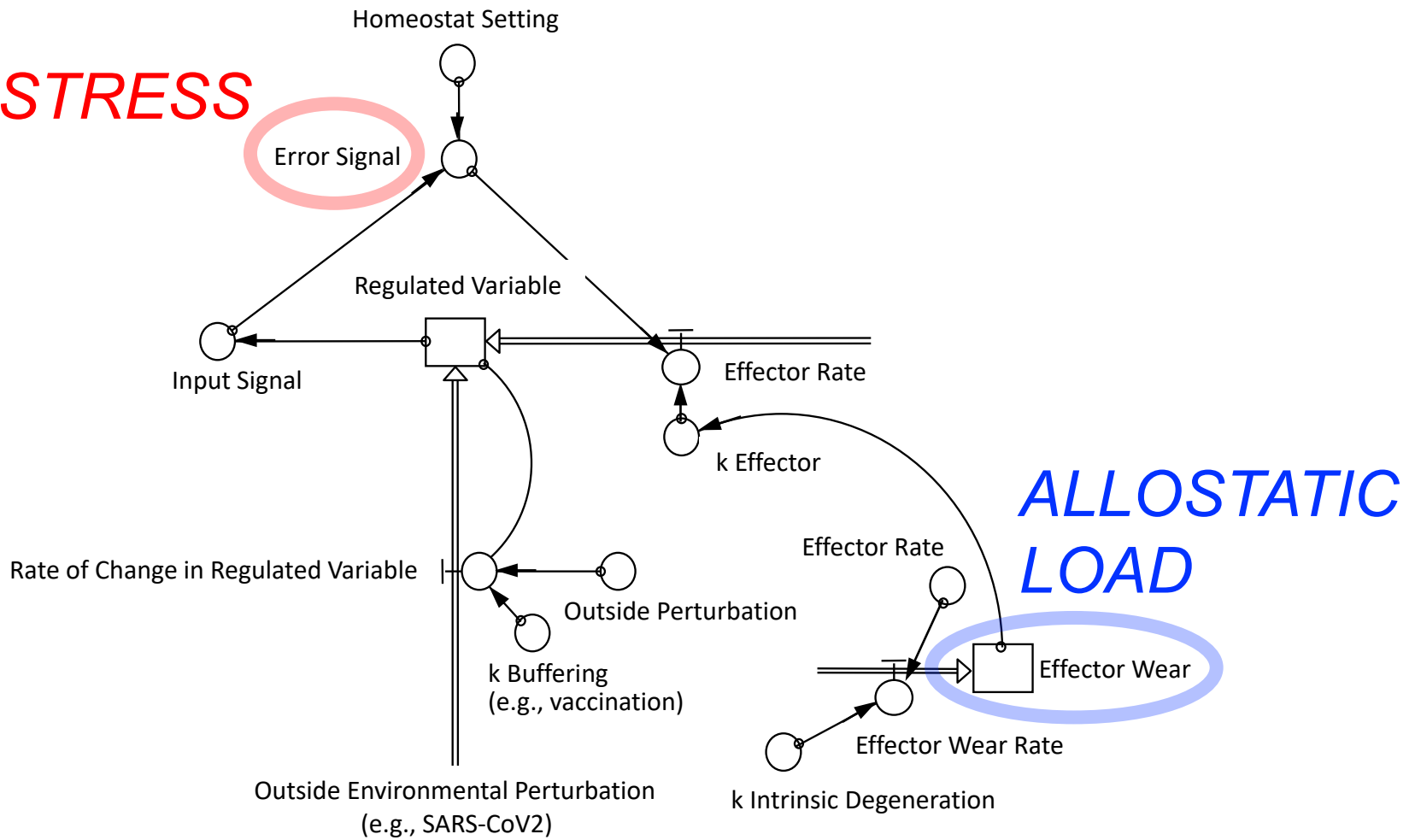
+++

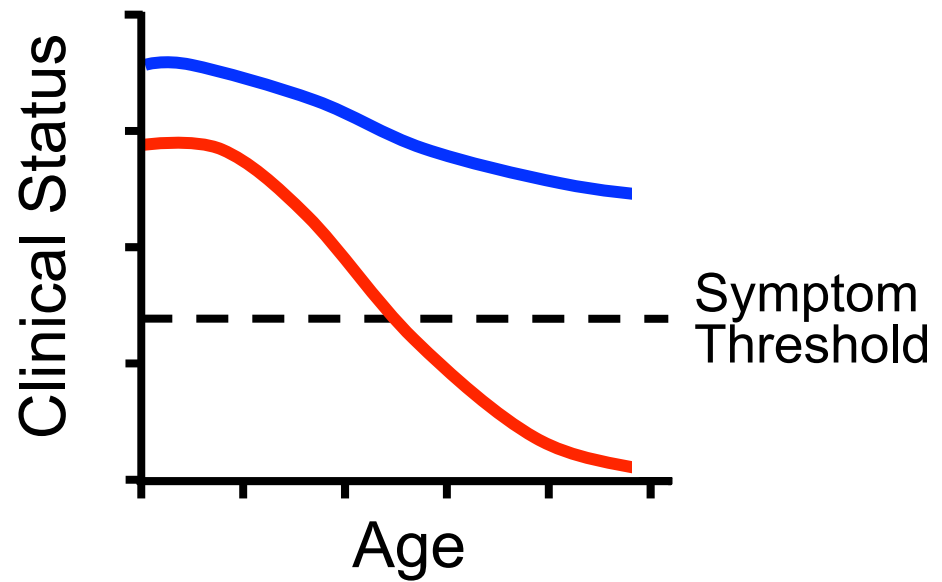
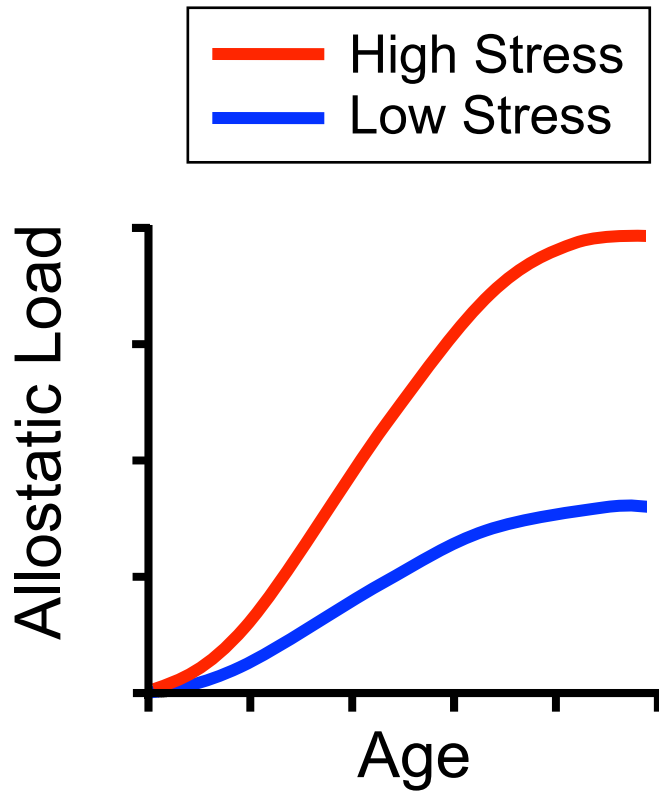
+

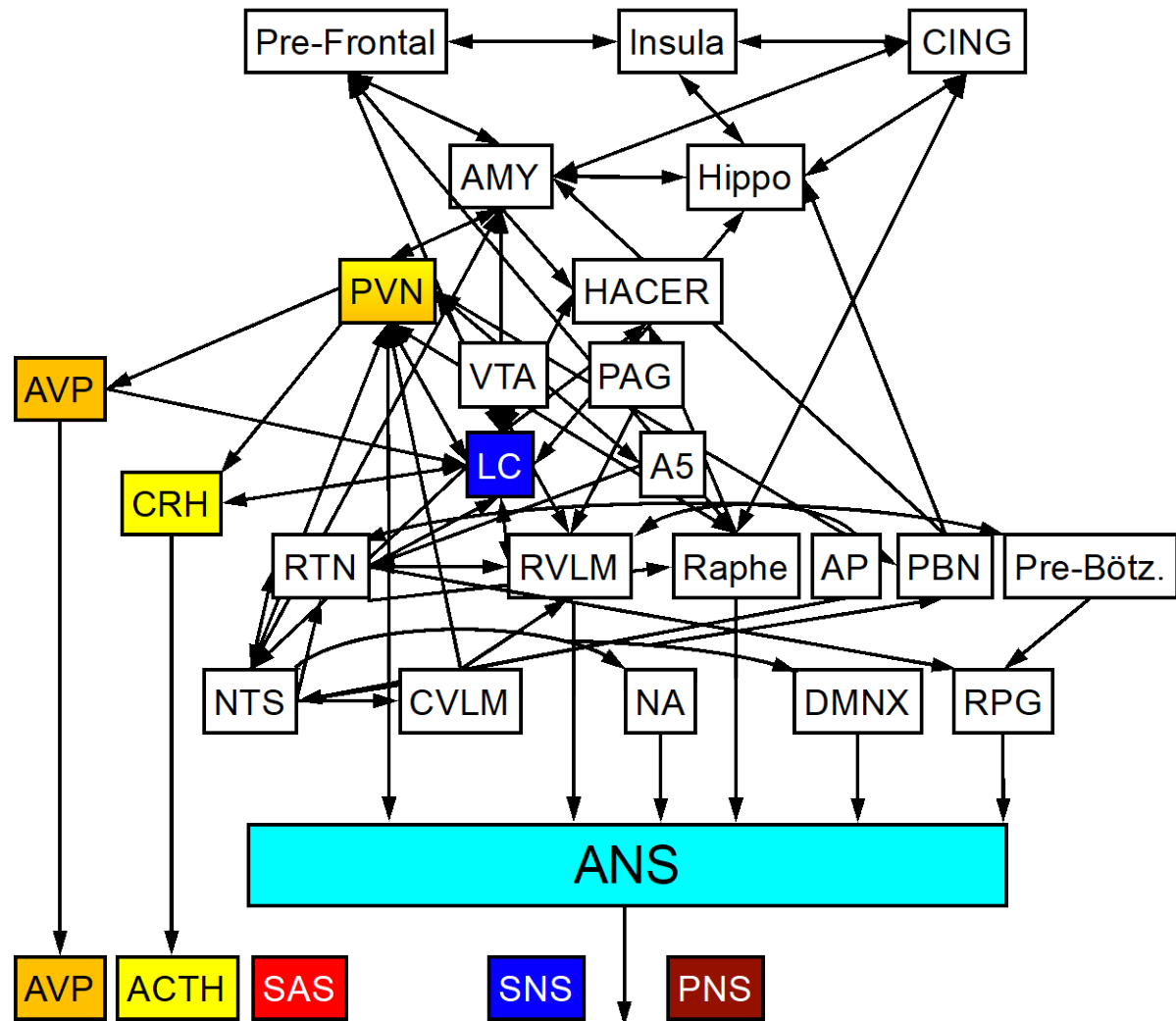
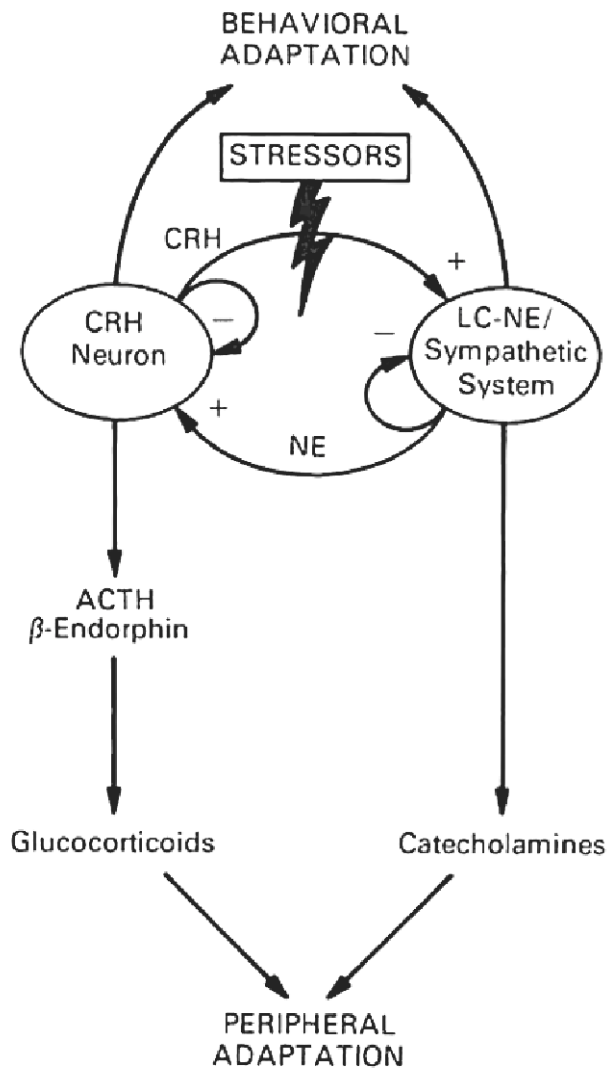




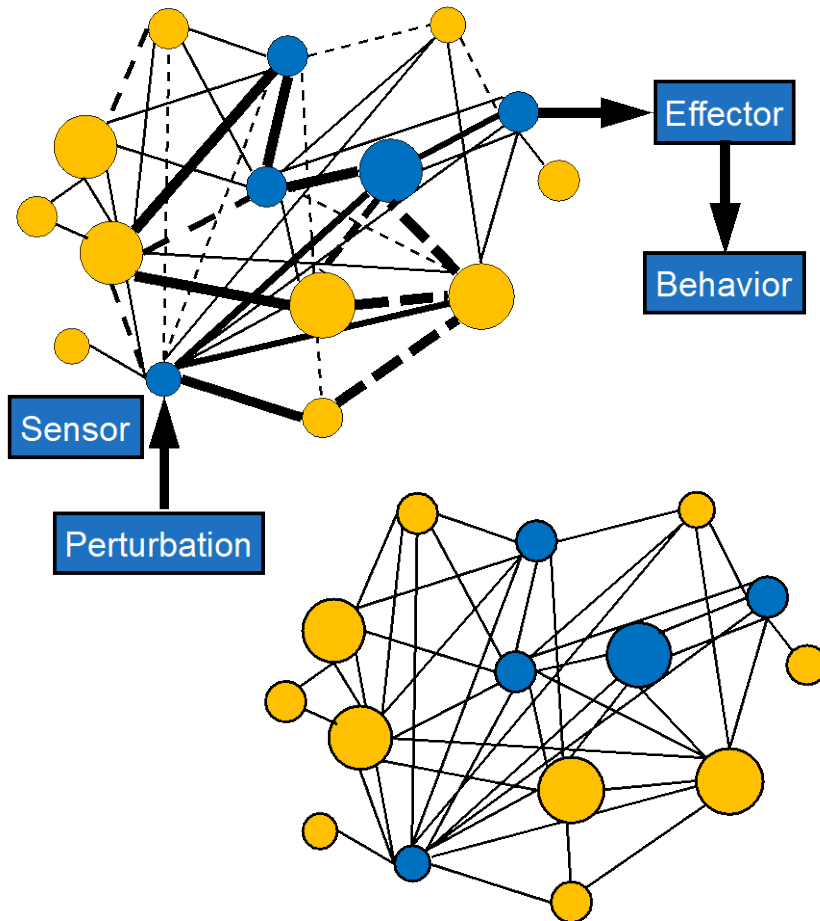
**STRESS**



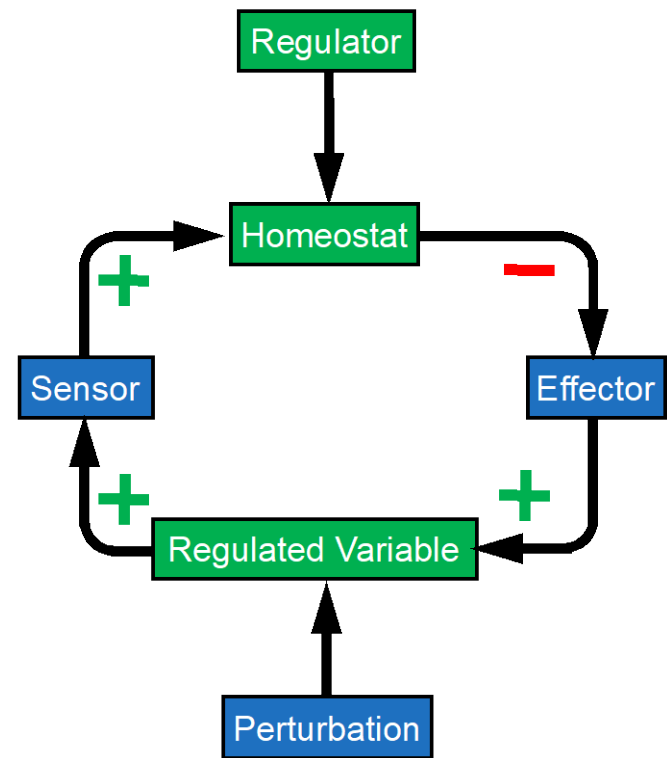




## Systems Biology



## Integrative Physiology







## Conclusions

---

- It's time to move beyond Langley's ANS (EAS=ANS+neuroendocrinology+immune/inflammatory systems+central autonomic network)
- It's time to move beyond negative feedback regulation: Feed-forward (allostasis) regulation, buffering
- It's time to move beyond Selye: Primitive specificity of stress responses
- It's time to move beyond systems biology vs. integrative physiology: Darwinian medicine.